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2020 Groundwater Sustainability Plan Comment Letters

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May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Las Posas Valley Basin Groundwater Sustainability Plan (GSP)

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Fox Canyon Groundwater Management Agency's Las Posas Valley Basin (LPVB) Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing *sustainable* groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be insufficient in addressing environmental beneficial uses and users.

The identification of environmental beneficial users, as well as their consideration when establishing the sustainability goal, undesirable results, minimum thresholds and measurable objectives were insufficient (23 CCR §355.4(b)(4)) and lacked best available science (23 CCR §355.4(b)(1)). In the face of existing, severe overdraft, the GSP would allow groundwater management to largely ignore potential impacts to environmental beneficial users. This could result in irreparable harm to these beneficial users, undermining the intent of SGMA to achieve sustainability.

Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address within 180 days. In these cases, we strongly recommend that the Department set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We appreciate that the GSA incorporated a portion of our feedback (10 of 25 comments were addressed), however, we disagree with the components where our feedback was ignored or dismissed. This suggests a limited degree of engagement of environmental beneficial users and could result in a definition of sustainability that is biased towards a limited set of users in the basin. In our experience, the GSP did not "adequately respond(d) to comments that raise credible technical or policy issues with the Plan," (23 CCR §355.4(b)(10).

Regarding the GSP development process, TNC would like to commend the GSA for including an environmental representative, a TNC staff member, on the Technical Advisory Group (TAG). This inclusion enabled TNC to voice concerns on behalf of environmental beneficial users the GSP development process. The quality of portions of the plan benefitted from the ad hoc TAG subcommittee that was formed to evaluate GDEs in the subbasin. The impact of this group extends beyond this GSP because their efforts helped to develop a GDE guidance document that is now being used by dozens of GSAs across the state. In addition, a special TAG public workshop was convened to discuss GDEs and solicit input from the public. TNC, many other environmental non-governmental organizations (NGOs), and federal resource agency provided feedback on the draft GSP.

TNC recommendation: We recommend that DWR require the GSA to prioritize stakeholder engagement, resulting in stakeholder input being incorporated into the plan. Improvements can be achieved through enhancements to the stakeholder engagement plan, partnerships with NGOs and community members, more representative governance and funding decisions.

Interconnected Surface Waters – The GSP incorrectly excluded actual ISWs because the plan did not employ the best available science. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). Arroyo Simi–Las Posas is a complex series of gaining and losing reaches that are connected to the Shallow Alluvial Aquifer. The GSP spatially identifies ISWs and includes a brief overview of the gaining and losing reaches of the Arroyo Simi–Las Posas based on source water data, streamflow gages, and a field study of the gain and losing reaches with an estimated recharge rate from Arroyo Simi–Las Posas to Shallow Groundwater. This study was performed in September 2011, during an average water year and revealed that the arroyo is a complex series of gaining and losing reaches. In fact, the groundwater levels are sufficiently high so that groundwater connects back to the surface of the arroyo in the middle stretch of the arroyo. We strongly disagree with incorrect language throughout the GSP stating that the arroyo is a losing stream and that the surface water and groundwater are disconnected.

TNC recommendation: Until a disconnection can be proven, TNC recommends that the GSP include all potential and confirmed ISWs. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystems – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 537 acres of potential GDEs occur in the GSA boundary. TNC developed the *Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs*[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

While we were pleased to see that GDEs were identified and mapped, the GSP did not consider GDEs as a beneficial user throughout the plan. We recommend that the GSP be revised to consider GDEs, as a beneficial user, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives.

The GSP characterizes the riparian ecosystem around the Arroyo Simi-Las Posas as a potential GDE due to perennial flows provided by non-native source waters. The riparian ecosystem around the Arroyo Simi-Las Posas should be considered a GDE. It should *not* be characterized as a *potential* GDE. There are sufficient data and studies (CMWD 2012, 2013) that demonstrate the connectivity of the GDE and the source water replenishing groundwater. It must be emphasized that the recognition of the non-native source waters does **not** negate this groundwater-surface water connectivity. GDEs are "ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" (23 CCR §351 (m)). By definition, the water source does not play a part in the *identification* of GDEs and thus the focus on "native flow" in identifying the GDE is incorrect. See Identification, Mapping and Description of GDEs Section in Attachment B. GDEs are a beneficial use of groundwater and the criteria are intended to prevent significant and undesirable impacts to beneficial uses of groundwater under current and future conditions. Given potential future conditions with decreased discharge from the Simi Valley and Moorpark wastewater facilities, the Arroyo Simi-Las Posas GDE should be considered in the sustainability goal and sustainability criteria should be defined for interconnected surface water [see Undesirable Results Section in Attachment B].

TNC recommendation: The GSP utilizes groundwater levels that represent interannual and inter-seasonal variability along with additional information provided in our BMP guidance document (Attachment D) to identify and consider GDEs in the GSP. Specifically, please ensure that a Digital Elevation Model (DEM) is used when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment D.

Water Budget – We were disappointed to see that the water budget did not include the current, historical and projected demands of native vegetation and/or managed wetlands, as required under SGMA (23 CCR §354.18(a) and (b)(3)). The GSP lists (Table 2-7) riparian evapotranspiration (ET) rates that are not consistent with the rates in the Technical Memorandum: Summary of Additional Refinements to the Groundwater Model of East and South Las Posas Sub-Basins (Intera, 2018), this discrepancy is not clarified in the text, and estimated riparian ET is attributed to arundo (an invasive species subject to management actions). The GSP only focused

[1] Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

on a subset of water use sectors, such as urban and agricultural users of groundwater, and water sources outside the FCGMA's area that are "out of their control". Water sources need to be adequately differentiated and understood prior to disregarding ISWs and GDEs. This is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget nor will they likely be considered in project and management actions.

<u>TNC recommendation:</u> As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

<u>TNC recommendation</u>: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

The Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. As a result, the monitoring network does not adequately characterize GDEs and other environmental beneficial users of surface water and groundwater.

<u>TNC recommendation:</u> TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess potential impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but *sustainable* groundwater management that considers the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Groundwater Sustainability Plan for the Las Posas Valley Basin

The complete Final GSP for the Las Posas Basin, adopted December 13, 2019 as Resolution 19-05, was reviewed by TNC. TNC submitted comments on the Public Draft GSP on September 17, 2019. However, specific responses to comments on the Public Draft were not publicly available so we compared the Public Draft GSP to the Final GSP to determine if changes were made to the Final GSP text that addressed TNC's previously submitted comments. This attachment lists our original comments on the complete Public Draft GSP, as submitted to the Fox Canyon Groundwater Management Agency during the public comment period, and states whether or not they were addressed in the Final GSP [as green text within brackets]. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

[Section 1.8.2 – Summary of Beneficial Uses and Users (p. 1-32) and Table 1-9 (p. 1-46)]

- *[Minor changes to GSP text do not adequately address the comment.]* We find the characterization of the Arroyo Simi–Las Posas GDE as a losing stream to mischaracterize the groundwater-surface water interconnection and thus it inappropriately concludes that the riparian plants are "using percolating surface water rather than groundwater". The Arroyo Simi–Las Posas should be characterized as a complex system of losing-gaining-losing reaches across the LPVB; groundwater is shallow and the riparian ecosystem likely uses a combination of unsaturated soil pore water and groundwater to supply its water needs. The GSA has included representation of environmental users on their Technical Advisory Group (TAG), in a special meeting on GDEs and in GSP email and meeting notifications. We also recommend that the GSP specifically list the natural resource agencies, NOAA's National Marine Fisheries Service (NMFS), United States Fish and Wildlife Service (USFWS), and California Department of Fish and Wildlife (CDFW), as stakeholders since they are important parties representing the public trust. In addition, both the CDFW and the USFWS agencies have attended the special TAG GDE meeting.
- *[Our comment has been adequately addressed through GSP text changes. Thank you for making this change that promotes better delineation of native habitat and its environmental value.]* In Table 1-9, please revise the Land Use Category from "Vacant" to "Open Space". As noted in Section 1.3.2.3 - Historical, Current, and Projected Land Use and Section 1.6.1 – General Plans, this is a substantial acreage that is valued highly in Ventura County as open space, with ordinances such as the 1998 Save Open Space and Agricultural Resources ordinance. We need to do a better job of delineating open space and native habitat from the "vacant" category, as this

devalues the environment and its water need. The Executive Summary (p. ES-3) correctly describes the land use as open space.

Checklist Items 6 and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 2.2 Hydrogeologic Conceptual Model]

- *[Minor changes to GSP text do not adequately address the comment.]* Section 2.2 should be revised to incorporate the latest knowledge provided by the Epworth Gravels Management Area (ELPMA) groundwater model (Intera, 2018). The characterization provided both in the analysis (e.g., Section 5.0 Groundwater Occurrence and Movement) and by the numerical model provide a much fuller understanding of the hydrogeological conceptual model.
- *[Minor changes to GSP text do not adequately address the comment.]* The Hydrogeologic Conceptual Model should describe the shallow groundwater that is interconnected with surface waters and GDEs. There is a brief mention of a "shallow aquifer system" in the West Las Posas Management Area (WLPMA) in Section 2.2 - Hydrogeologic Conceptual Model. There is no discussion of this in Section 2.2.1 - Geology. The description of the Recent Alluvium mentions only the "aquifer beneath the floodplain of Arroyo Simi–Las Posas." Hydrogeologic Conceptual Model The description of the Shallow Alluvial Aquifer in Section 2.2.4 – Principal Aquifers and Aquitards, which was specifically stated as being in the ELPMA, there is a statement that doesn't belong: "The alluvium is also present in the WLPMA in Beardsley Wash and Ferro Ditch (Figure 2-2)." Presumably, this is an attempt to discuss the "shallow aquifer system" in the WLPMA. Figure 2-4 shows the "Shallow Alluvial Aquifer" extending from the Wright Road fault to Bradley Road. In contrast, the UWCD model only includes aquifers of the Upper Aquifer System (UAS) extending to about ½ mile east of the Wright Road fault (UWCD, 2018). As summarized in Table 2-10a, the pumping data (average of 1,397 AF/yr) for the shallow aquifer system and the water budget numbers from the UWCD numerical model indicate this is a water producing aquifer. These different statements lead to a significant amount of confusion by the reader. This shallow aquifer system should be much better characterized in Section 2.2.4.

  In particular, our concern for clarity is in regards the potential for this shallow aquifer to support any potential GDEs, such as the riparian ecosystem identified in the Beardsley Wash. Earlier discussions during TAG meetings had indicated that there was **not** a shallow aquifer unit in WLPMA. Thus, the riparian habitat along the Beardsley Wash were assumed to be supported during dry summer periods by agricultural runoff, and/or residential development outdoor water use and excluded from further consideration (see Appendix I). This needs to be reconsidered.

- *[Our comment has been adequately addressed through GSP text changes. Thank you for clarifying the currently available data and knowledge.]* Section 2.2.4 (p. 2-10): The statement: "Currently, there are few wells that produce water from the Shallow Alluvial Aquifer, which is likely a result of the marginal-quality water and low well yields compared to the FCA [Fox Canyon Aquifer]" is misleading. The Calleguas

Municipal Water District's (CMWD) numerical model report (Figure 7-11, Intera, 2018), shows at least 30 production wells in the Shallow Alluvial Aquifer. Figure 1-7 shows a significantly different set of wells. Section 2.4 - Water Budget, indicates an average pumping rate in the Shallow Alluvial Aquifer of 383 AF/yr, with a range from 203 to 972 AF/yr over the historical period.

[Section 2.3.1.2.1 Shallow Alluvial Aquifer: Vertical Gradients (p.2-20)]

- *[No changes to GSP text made.]* This section only refers to the one nested well pair in the Shallow Alluvial Aquifer. That one data point indicates a small upward gradient and thus presents a very confusing picture of the flow from the Shallow Alluvial Aquifer to the Upper San Pedro since it is very well established that there is a downward vertical gradient through the Shallow Alluvial Aquifer through the San Pedro and also down to the Fox Canyon.

<u>Checklist Items 8, 9 and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16); and Identification of ISWs is a required element of Current and Historical Groundwater Conditions (23 CCR §354.16)</u>

[Executive Summary; Sections 1.3.2.1, 2.3.6, 2.3.7, 2.4.1.1, 2.4.2.5, and Appendix K]

- *[Minor changes to GSP text do not adequately address the comment.]* Arroyo Simi–Las Posas is a complex series of losing, gaining and losing reaches that are connected to the Shallow Alluvial Aquifer. ISWs have been spatially identified, including a brief overview of the gaining/losing reaches of the Arroyo Simi–Las Posas based on source water data, streamflow gages, and a field study of the gain/losing reaches with an estimated recharge rate from Arroyo Simi–Las Posas to Shallow Groundwater. This study was performed in September 2011, during an average water year and reveals that the arroyo is a complex series of losing, gaining and losing reaches. In fact, the groundwater levels are sufficiently high and water surfaces back to the arroyo in the middle stretch of the arroyo. Figure 2-16 maps out the losing and gaining reaches and presents a clear understanding of the interconnected system in ELPMA. We strongly disagree with misleading language throughout the GSP stating that the arroyo is a losing stream and that the surface water and groundwater are disconnected. These include:
    - Executive Summary - (ES.2) Summary of Basin Setting and Conditions (p. ES-6) "Increased surface water flow and infiltration along Arroyo Simi–Las Posas also resulted in the establishment of riparian vegetation, along the banks of the arroyo. This riparian vegetation, which is dominated by non-native Arundo (*Arundo donax*), has been identified as a potential groundwater-dependent ecosystem. Within the boundaries of the ELPMA, Arroyo Simi–Las Posas is generally a losing stream, meaning that the groundwater table is below the stream bed, and water from Arroyo Simi–Las Posas percolates into the underlying sediments to recharge the groundwater. This leads to the conclusion that the riparian habitat along Arroyo Simi–Las Posas may rely on soil moisture from percolating surface water, rather than groundwater. As surface flows and recharge decrease in Arroyo Simi–Las

Posas, groundwater elevations and soil moisture content in the vicinity of the potential groundwater-dependent ecosystem are anticipated to decline. These declines may impact the health of the riparian vegetation."

This language is misleading as it portrays a disconnected groundwater-surface water ecosystem. The Arroyo Simi–Las Posas is a mix of gaining and losing reaches and *is* connected to the Shallow Alluvial Aquifer. Only at the LPVB boundary, where the Arroyo Las Posas has gone dry since 2012, is there a disconnection between the surface water and groundwater. Ecosystems often rely both on groundwater and surface water to meet their water needs (see Best Management Practice #3 in Attachment D of this letter). A strictly binary approach, designating all GDEs as either 100 percent reliant on groundwater or 100 percent reliant on surface water supplies is therefore inconsistent with the available science. The above "conclusion" is conjecture and the statement should be revised.

- Executive Summary - (ES.3) Overview Of Sustainability Criteria (p. ES-9) "Depletion of interconnected surface water is not occurring within the LPVB, where Arroyo Simi–Las Posas is a losing stream, with groundwater elevations that have been below the bottom of the stream channel for decades." This is not an accurate statement, as Arroyo Simi–Las Posas is a mix of losing and gaining reaches and the groundwater elevations have been stable and high enough to intersect the stream channel for the past few decades. We do agree that depletions of ISWs are not occurring for the majority of the GDE, except along the LPVB boundary with Pleasant Valley, as noted above.

Checklist Items 11 to 20 - Identification, Mapping and Description of GDEs (23 CCR §354.16)

[Section 2.3.7 Groundwater-Dependent Ecosystems and the Executive Summary]

- *[Minor changes to GSP text do not adequately address the comment.]* GDEs have been identified and mapped during the GSP development process using an earlier version of the statewide database of GDE indicators (iGDE v0.3.1; TNC, 2017) and TNC's GDE Guidance document (Rohde et al., 2018). This evaluation is described in Appendix I, with a brief summary in Section 2.3.7. In addition to the mapping of basin GDEs, it also includes both an assessment of the hydrologic and ecological conditions of the GDEs and potential GDEs.

  The Arroyo Simi–Las Posas *should* be considered a GDE. It should *not* be characterized as a *potential* GDE. Non-native flows from the Simi Valley and Moorpark waste water treatment plants and the Simi Valley groundwater dewatering wells have both provided perennial flows in the Arroyo Simi-Las Posas and filled the Shallow Alluvial Aquifer such that under current conditions, the Arroyo Simi-Las Posas and Shallow Alluvial Aquifer is an interconnected system. There are sufficient data and studies (CMWD 2012, 2013) that demonstrate the connectivity of GDE and the surface water itself. It must be emphasized that the recognition of the non-native source waters does **not** negate this groundwater-surface water connectivity. GDEs are "ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" (23 CCR §351 (m)). By definition, the water source (native or non-native) does not play a part in the *identification* of GDEs. The focus on "native flow" as defining a GDE is a fundamental flaw. The source of water entering an aquifer has never been a factor in defining groundwater. In fact, about 93% of the inflows into the ELPMA are from non-native sources (see Table 2-7) yet the GSP considers all of it groundwater.

There are many misleading statements that attempt to discount the groundwater-surface water connection and the Arroyo Simi–Las Posas GDE by overemphasizing the water source. We request that such statements be revised or removed. These include:

- Executive Summary – see above listed language
- *[Text was removed from the final GSP]* (Section 2.3.7, p. 2-36) "However, the riparian vegetation in the Arroyo Simi–Las Posas composing these potential GDEs was established and is maintained by discharges from wastewater plants and Simi Valley dewatering discharges to Arroyo Simi."
- *[Text was removed from the final GSP]* (Section 2.3.7, pp .2-36 to 2-37) "The gaining reach is caused by surface water that is resurfacing rather than by discharge of native groundwater (CMWD 2012, 2013)."
- *[Text was removed from the final GSP]* (Section 2.3.7, p. 2-38) "Until a connection between groundwater elevations under native flow conditions and the potential GDE is established, the Arroyo Simi–Las Posas potential GDE cannot be conclusively determined to be a GDE."

Again, the source of the groundwater, native or otherwise, does not alter the fact that it is groundwater and therefore should be considered as such when evaluating whether it supports a potential GDE.

- *[Minor changes to GSP text do not adequately address the comment.]* The confusing information about the shallow aquifer in WLPMA, which was not presented in the 2017 Preliminary Draft GSP, needs to be assessed as to whether there is a hydrologic connection to any potential GDEs, such as the riparian ecosystem identified in the Beardsley Wash. Earlier discussions during TAG meetings had indicated that there was not a shallow aquifer unit in WLPMA. Thus, the riparian habitat along the Beardsley Wash were assumed to be supported during dry summer periods by agricultural runoff, and/or residential development outdoor water use and excluded from further consideration (see Appendix I of the GSP). This needs to be reconsidered and described in Section 2.3.7.

<u>Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)</u>

[Section 2.4 Water Budget]

- *[Minor changes to GSP text do not adequately address the comment.]* The water budget includes the Shallow Alluvial Aquifer in the ELPMA and the shallow aquifer in the WLPMA. In the ELPMA, the Arroyo Simi-Las Posas is a net recharge to the Shallow Alluvial Aquifer and the Arroyo Simi-Las Posas riparian vegetation evapotranspiration (ET) is a discharge from the Shallow Alluvial Aquifer. The riparian

ET is estimated as Arundo, and average ET is estimated as 1,062 AF/ac in Table 2-7. Section 2.4.2.2, Riparian Evapotranspiration Losses incorrectly describes the use of the consumptive water use of 24 AF/ac; The second paragraph correctly describes the calculation method of the ETo and crop coefficient. However, table 2-7 lists riparian ET rates that are not consistent with the rates in the Technical Memorandum: Summary of Additional Refinements to the Groundwater Model of East and South Las Posas Sub-Basins (Intera, 2018).

Checklist Items 23 to 25 – Sustainability Goal (23 CCR §354.24)

[Section 3.1 Introduction to Sustainable Management Criteria (p. 3-1 to 3-2)]

- *[No changes to GSP text made.]* The FCGMA Board of Directors adopted planning goals in 2015 that "Promote water levels that mitigate or minimize undesirable results (including pumping trough depressions, **surface water connectivity** [emphasis added], and chronic lowering of water levels)."
- The GDEs should be considered in the sustainability goal. GDEs are a beneficial use of groundwater and the criteria are intended to prevent significant and undesirable impacts to beneficial uses of groundwater under current and future conditions.

Checklist Items 30 to 46 - Undesirable Results (23 CCR §354.26)

[Section 3.3.6 Depletions of Interconnected Surface Water (pp. 3-14 to 3-15)]

- *[The undesirable result associated with depletion of ISWs in the LPVB is unequivocally stated to be the loss of GDE habitat. We applaud that recognition.]* We do not agree with the misleading language that continues to be used to dismiss the groundwater-surface water connection. Please see comments above with respect to Interconnected Surface Waters and Identification, Mapping and Description of GDEs. This nonsensical concept of resurfacing surface water not being groundwater is used to conclude that there will not be significant and unreasonable effects on beneficial uses of surface water such as GDEs.
- *[Our comment has been adequately addressed through GSP text changes. Thank you for clarifying current groundwater conditions.]* We do agree that *current* groundwater conditions in the LPVB do not impact the volume of flow in Arroyo Simi–Las Posas and groundwater production from the ELPMA will not result in depletion of ISWs with significant and unreasonable adverse effects on beneficial uses of surface water.
- *[Our comment has been adequately addressed through GSP text changes. Thank you for clarifying potential future groundwater conditions.]* However, in the future, an anticipated cause of groundwater conditions that would lead to depletions of ISWs and impacts to the Arroyo Simi-Las Posas GDE is decreased discharge from the Simi Valley and Moorpark wastewater discharges and Simi Valley dewatering wells. These discharges are a very important source of inflow to the ELPMA providing nearly 40% of the total annual recharge, and would also lead to decreased surface water flows, disconnection of the surface water and groundwater, and lowering of chronic lowering of groundwater levels in the Shallow Alluvial Aquifer and Fox Canyon

Aquifer, and interbasin interflow from the Las Posas Valley Basin to the Pleasant Valley Basin.

- *[Our comment has been adequately addressed through GSP text changes.]* Such a change, however, is unrelated to groundwater production from the Shallow Alluvial Aquifer and is outside of the jurisdictional powers of the FCGMA to prevent. However, given the SGMA goal of management of groundwater that will promote water levels that mitigate or minimize any potential future undesirable results of depletions of ISWs and the associated Arroyo Simi–Las Posas potential GDE, TNC proposes inclusion of this aspirational goal (Section 354.30(g), Measurable Objectives) with recognition of the dependence on the continuation of these external water sources.
- *[Our comment has been adequately addressed through GSP text changes.]* Recognition that external constraints (i.e., potential future loss of out-of-basin source waters) can result impacts to ISWs and GDEs was discussed with the California Department of Water Resources (DWR) and State Water Resources Control Board (SWRCB) (June 8, 2017 meeting). In particular, DWR was noted that SGMA §354.30(g) states: "An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan." It was recognized that striving for an "aspirational goal" would be appropriate in this circumstance. We recommend inclusion of the "aspirational goal" when setting sustainability criteria for ISWs and the associated Arroyo Simi-Las Posas GDE.
- *[Our comment has been adequately addressed through GSP text changes.]* Therefore, the sustainability goal would recognize that under circumstances where external constraints result in impacts to the GDE, the FCGMA would not be obligated to address those impacts, if it is at the expense of other beneficial users (e.g., cutting back groundwater extractions by agricultural users). The GSA would only be obligated to address impacts to the GDE caused by changing groundwater conditions resulting from pumping or groundwater management under the jurisdiction of the GSA that cause undesirable results.
- *[No changes to GSP text made.]* In WLPMA, there needs to be a revised evaluation as to any hydrologic connection between the shallow aquifer system and any potential GDEs identified in the NC Dataset.

[Section 3.3.7 Defining Undesirable Results (p. 3-16)]

- *[No changes to GSP text made.]* For ELPMA, addressing chronic lowering of groundwater levels and depletion of groundwater storage is assumed to be protective for ISWs. And, the ELPMA will be determined to be experiencing undesirable results if, in any single monitoring event, groundwater levels in 5 of the 15 key wells are below their respective minimum thresholds. Given that the future depletions of ISWs (and loss of the Arroyo Simi-Las Posas GDE) is only related to lowering of groundwater levels in the Shallow Alluvial Aquifer, this definition does not make sense. The two key wells in the Shallow Alluvial Aquifer should be assessed separately to determine whether there could be future undesirable results.

Checklist Items 27 to 29 – Minimum Thresholds (23 CCR §354.28)

[Section 3.4 Minimum Thresholds (p. 3-17)]

- *[No changes to GSP text made.]* The avoidance of undesirable results should include the aspirational goal of maintain groundwater levels in the ELPMA Shallow Alluvial Aquifer to prevent future depletions of ISWs and loss of the Arroyo Simi-Las Posas GDE.

[Section 3.4.2.6 ELPMA Minimum Thresholds – Depletions of Interconnected Surface Water (pp. 3-24 to 3-25)]

- *[No changes to GSP text made.]* The GSP defines the minimum thresholds to address chronic lowering of groundwater levels and depletion of groundwater storage are to be protective of the Arroyo Simi-Las Posas GDE. Two wells to monitor representative groundwater conditions were selected in the Shallow Alluvial Aquifer are 02N20W09Q08 and 02N20W12MMW1. The proposed minimum thresholds are 170 and 300 feet MSL for 02N20W09Q08 and 02N20W12MMW1, respectively. Both of these are significantly below the historical lows of 271 and 358 feet MSL and the current condition (represented by Fall 2015) of 271 and 369 feet MSL for 02N20W09Q08 and 02N20W12MMW1, respectively. We disagree and find these proposed minimum thresholds to be entirely inappropriate.

  Based on literature studies, groundwater depths within the range considered necessary for juvenile establishment of willows and cottonwoods, typical focal phreatophytic species for riparian ecosystems, are less than 10 feet and for mature vegetation growth are less than 20 feet (Stillwater Sciences, 2016). Site-specific knowledge of groundwater use by the riparian vegetation is not known at this time. Although the literature studies suggest 20 feet bgs is a reasonable minimum threshold value for the GDE, it is uncertain what is the actual site conditions in the Arroyo Simi – Las Posas GDE. The recommended key well (02N20W12MMW1), which is located outside of the GDE, has average depth to groundwater of 21 feet bgs at the well, with a range of 18 to 27 feet bgs. This well has a long-term representative time period (1996-present). The proposed minimum threshold of 170 feet MSL would represent a depth to groundwater that is 200 feet lower than the average water level; this would not be supportive of any riparian vegetation. We recommend a minimum threshold protective of the GDE at the historical groundwater elevation of 358.2 feet MSL.

  On the western losing reach of the GDE where key well 02N20W09Q08 is located, there has been a significant decrease in the vegetative health of the GDE since 2013. Water levels in key well 02N20W09Q08 average 38 feet bgs, with a range of 35 to 40 feet bgs (time period 2014 to present). Given that this well has only been monitoring groundwater levels since 2014, it is unclear what a realistic minimum threshold should be. Also, as the well is not actually within the GDE and ground surface elevations in this area are quite variable, accurately determining depths to groundwater within the GDE is the necessary first step before recommending realistically protective minimum thresholds. This should be done by the 5-year plan update.

In addition, there is an observed decline in ecosystem health in the western losing reach where key well 02N20W09Q08 is located that is visible in the remote sensing vegetation metrics, NDVI and NDMI (Figure 14, Appendix I). However, as shown in Figure 10 (Appendix I), there is a large range in the depth to groundwater in this losing reach. It is recommended that field-based work be conducted to accurately determine depths to groundwater within the GDE and thus support a site-specific minimum threshold for the GDE.

Following the precautionary principle, it is recommended that the minimum threshold for key well 02N20W12MMW1 be set at its minimum historical level (358.2 feet MSL). The recommendation recognizes there is uncertainty regarding these analyses herein regarding equivalent GDE depths and correlations with declining ecosystem health that can be addressed with additional field-based assessment and then revised in the next 5-year plan update.

Checklist Item 26 – Measurable Objectives (23 CCR §354.30)

[Section 3.5.2.6 Measurable Objectives – Depletions of Interconnected Surface Water (pp. 3-33 to 3-34)]

[Our comment has been adequately addressed through GSP text changes. Thank you for making this change that promotes the sustainability goal.] Current groundwater levels, as raised and sustained by wastewater plant and dewatering discharges, have been relatively constant since the 1980s and have provided for establishment and maintenance of the GDE. Under the current assumption that baseline conditions are representative of GDE conditions and thus currently represent sustainable conditions, our recommendation is therefore to set the measurable objective at the baseline average groundwater elevation. For the key wells 02N20W12MMW1 and 02N20W09Q08, it is recommended that the measurable objectives be set to 370 and 272 ft MSL, respectively. It is recognized that maintaining such levels is depended upon continued wastewater plant and dewatering discharges, though not regulated by the GSA. However, proposed projects in the GSP can ensure these sustainability criteria are met for the GDE beneficial use and continued recharge of Shallow Aquifer and Fox Canyon Aquifer.

No interim milestones are necessary given that current conditions are meeting the measurable objectives.

Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)

[Section 4.2.2 Surface Conditions Monitoring (p. 4-4)]

- *[No changes to GSP text made.]* The statement "Additionally, evapotranspiration from riparian vegetation lining Arroyo Simi–Las Posas impacts surface conditions by using surface water in the Arroyo" attributes the evapotranspiration (ET) from riparian vegetation as solely being from surface water. This assumption that all ET is from surface water is not verified. The CMWD numerical model specifically attributes the ET from groundwater. In reality, it is likely a combination of surface water, soil pore water, and groundwater. This is an area for further study as there are the ET of the non-native Arundo in the riparian ecosystem is potential water savings that is evaluated in Project No. 2 (see Section 5.3).

[Section 4.3.6 Depletions of Interconnected Surface Water (p. 4-10)]

- *[No changes to GSP text made.]* We recommend including remote sensing vegetative indices as a low cost approach to monitor baseline conditions of GDEs. TNC's free online tool, GDE Pulse (included as Attachment E), allows GSAs a way to assess changes in GDE health using remote sensing data sets; specifically, the Normalized Difference Vegetation Index (NDVI), which is a satellite-derived index that represents the greenness of vegetation and Normalized Difference Moisture Index (NDMI), which is a satellite-derived index that represents water content in vegetation.

[Section 4.6.5 Shallow Groundwater Monitoring near Surface Water Bodies and GDEs (p. 4-15)]

- *[No changes to GSP text made.]* We recommend continued monitoring of the existing set of shallow aquifer monitoring wells in the vicinity of the GDE to continue a record of groundwater conditions and to assess whether changes occur in the future (Figures 6-9, Appendix I): 02N19W09E01S, 02N19W0K01S, 02N19W08H02S, 02N19W07G01S, 02N19W07K04S, 02N20W12MMW1 (key well), 02N20W12MMW2, 02N20W12MMW3, 02N20W09Q08S (key well), 02N20W17J06S, 02N20W10K02S. Wells 02N19W0K01S, 02N20W12MMW1 (key well), 02N20W12MMW2, and 02N20W12MMW3 were not identified as monitored wells in Tables 4-3 to 4-5. Also, 02N19W08H02S was incorrectly listed in Table 4-3 as monitoring the Lower Aquifer System (LAS). These should be included. In particular, 02N20W12MMW1 is a specified key well.

  One limitation of this initial evaluation is that the estimation of groundwater levels in the GDE are approximated based on wells outside the GDE, using single point land surface GDE reference points. As a result, this analysis is a simplification of the groundwater depth representation for the Arroyo Simi - Las Posas GDE. In reality, the ground surface elevation varies as the GDE traverses upslope from the stream channel to the floodplain terraces and also longitudinally up or downstream. Refinement of the depth to groundwater mapping in the GDE would more clearly determine the impacts of decreasing groundwater levels on the riparian habitat. In particular, monitoring of groundwater levels in the GDE will characterize the degree to which the vegetation is reliant on groundwater. Mapping of the ground surface elevation in the GDE near the monitoring wells is a necessary task.

Checklist Items 50 and 51 - Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)

[Sections 5.3 and 5.4 Projects No. 2 & 3 (pp. 5-4 to 5-10)]

- *[Our comment has been adequately addressed through GSP text changes. Thank you for recognizing the importance and values of EBUs.]* Because treated water inflows are critical to maintaining extractions rates for agriculture and other beneficial users including the Arroyo Simi-Las Posas GDE the FCGMA approved two projects to be evaluated in the GSP (Project No 2. - Arroyo Simi-Las Posas Arundo Removal, and Project No. 3 - Arroyo Simi-Las Posas Water Acquisition). These projects are focused on maintaining the inflows into the basin.

  According to Section 354.44 of the SGMA regulations, projects are to achieve the sustainability goals for the basin. It goes on to say projects must include a "description of the measurable objective this is expected to benefit from the project". Therefore, the ELPMA GSP must include a goal(s) and measurable objective(s) tied to the purpose of Projects 2 & 3. Initially this created a quandary for the GMA because it is important to maintain the inflows from the treated water discharges, but it is not within the GMA's authority to ensure they continue. The SGMA addresses this by allowing aspirational goal where the agency creates an objective that may exceed its operational flexibility but failure to achieve the objective is not grounds for a finding of inadequacy (see Sec. 354.30(g).

  It is extremely important to include the EBUs in the establishment of the SMC. The proposed ELPMA projects are multi-benefit projects, and grant funding for such projects are predicated on the establishment of that position. Because both projects have co-benefits to both groundwater supply and the restoration of native habitat, the projects have access to multiple sources of funding. Without such clarity in the GSP, there is no justification for conservation funding. TNC is partnering with another NGOs that have already started the IRWM grant process in anticipation of the arundo removal project. We also want to jointly work to find funds for purchasing the Simi outfall water.

Attachment C

Freshwater Species Located in the Las Posas Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Las Posas Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[2]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the CDFW's BIOS[3] as well as on TNC's science website[4].

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
BIRDS				
Aix sponsa	Wood Duck			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas cyanoptera	Cinnamon Teal			
Anas platyrhynchos	Mallard			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya collaris	Ring-necked Duck			
Bucephala albeola	Bufflehead			
Butorides virescens	Green Heron			
Calidris minutilla	Least Sandpiper			
Egretta thula	Snowy Egret			
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Oxyura jamaicensis	Ruddy Duck			
Phalacrocorax auritus	Double-crested Cormorant			
Plegadis chihi	White-faced Ibis		Watch list	
Podilymbus podiceps	Pied-billed Grebe			
Tachycineta bicolor	Tree Swallow			

[2] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[3] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[4] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Tringa melanoleuca	Greater Yellowlegs			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
CRUSTACEANS				
Cyprididae fam.	Cyprididae fam.			
Hyalella spp.	Hyalella spp.			
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		SSC	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Pseudacris cadaverina	California Treefrog			ARSSC
Rana draytonii	California Red-legged Frog	Threatened	SSC	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	SSC	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		SSC	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTEBRATES				
Ablabesmyia spp.	Ablabesmyia spp.			
Aeshnidae fam.	Aeshnidae fam.			
Apedilum spp.	Apedilum spp.			
Baetidae fam.	Baetidae fam.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Callibaetis spp.	Callibaetis spp.			
Centroptilum spp.	Centroptilum spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Cricotopus trifascia				Not on any status lists
Cryptochironomus spp.	Cryptochironomus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Endochironomus spp.	Endochironomus spp.			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Ephydridae fam.	Ephydridae fam.			
Eukiefferiella claripennis				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Hydrobius spp.	Hydrobius spp.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Labrundinia spp.	Labrundinia spp.			
Limnophyes spp.	Limnophyes spp.			
Micropsectra spp.	Micropsectra spp.			
Parachironomus spp.	Parachironomus spp.			
Pentaneura spp.	Pentaneura spp.			
Petrophila spp.	Petrophila spp.			
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Pseudosmittia spp.	Pseudosmittia spp.			
Psychodidae fam.	Psychodidae fam.			
Simulium argus				Not on any status lists
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Tanytarsus spp.	Tanytarsus spp.			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus spp.	Tropisternus spp.			
MOLLUSKS				
Ferrissia spp.	Ferrissia spp.			
Lymnaeidae fam.	Lymnaeidae fam.			
Physa spp.	Physa spp.			
Pyrgulopsis stearnsiana	Yaqui Springsnail			
PLANTS				
Eleocharis macrostachya	Creeping Spikerush			
Lemna minuta	Least Duckweed			
Mimulus cardinalis	Scarlet Monkeyflower			
Phacelia distans	NA			
Populus trichocarpa	NA			Not on any status lists
Notes: ARSSC = At-Risk Species of Special Concern				

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
BCC = Bird of Conservation Concern BSSC = Bird Species of Special Concern CRPR = California Rare Plant Rank IUCN = International Union for Conservation of Nature SSC = Species of Special Concern				

Attachment D

July 2019

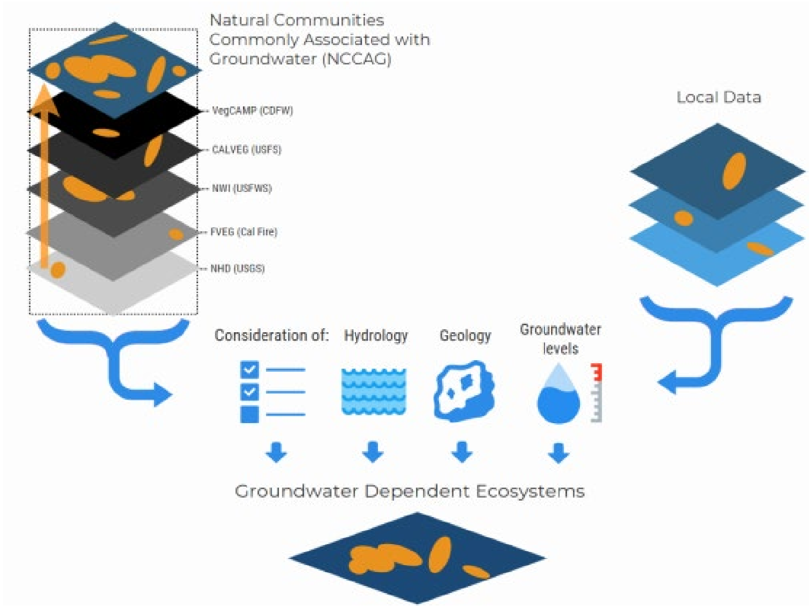
IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[5] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[6]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

[5] *NC Dataset Online Viewer:* *https://gis.water.ca.gov/app/NCDatasetViewer/*

[6] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf



The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[7]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[8] on the Groundwater Resource Hub[9], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may

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[7] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[8] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[9] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

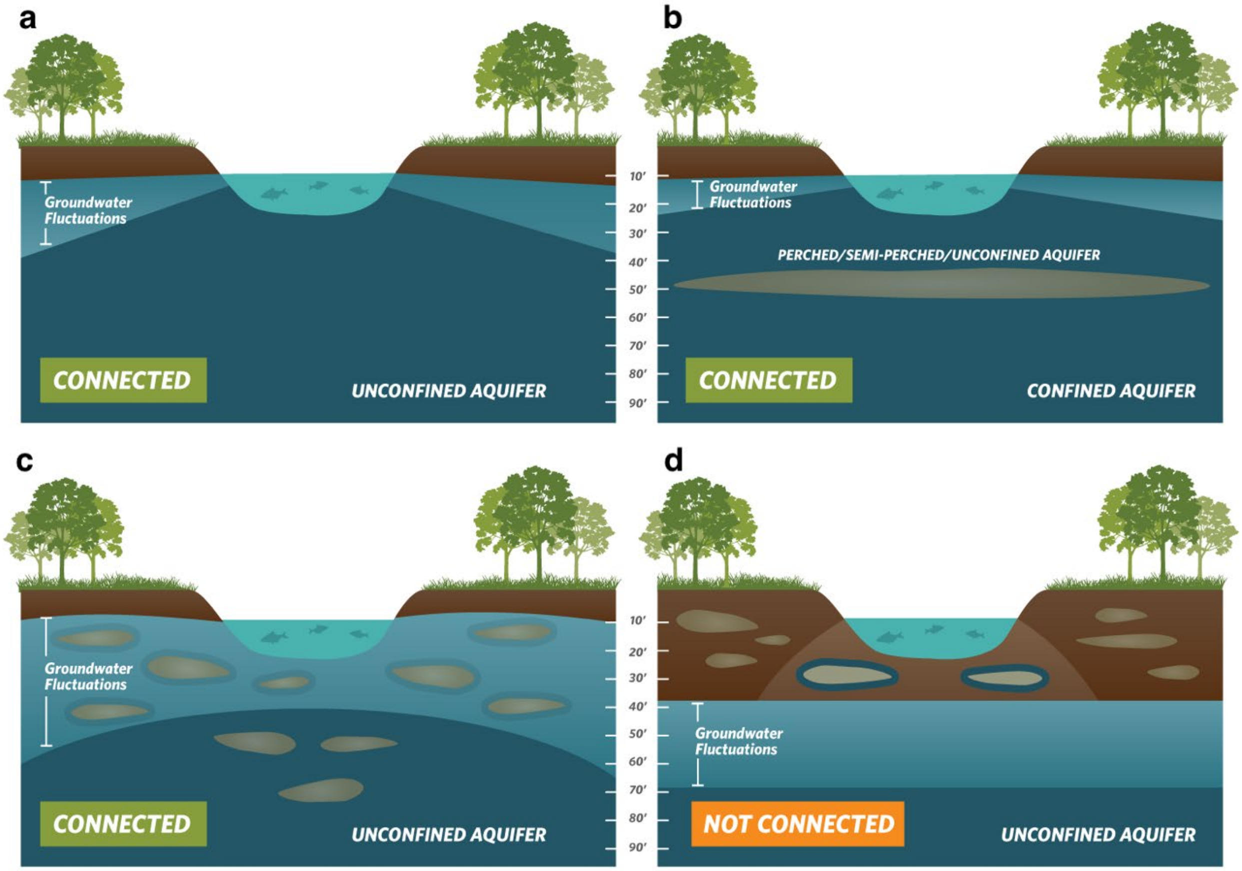

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[10] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[11] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[12] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[13]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

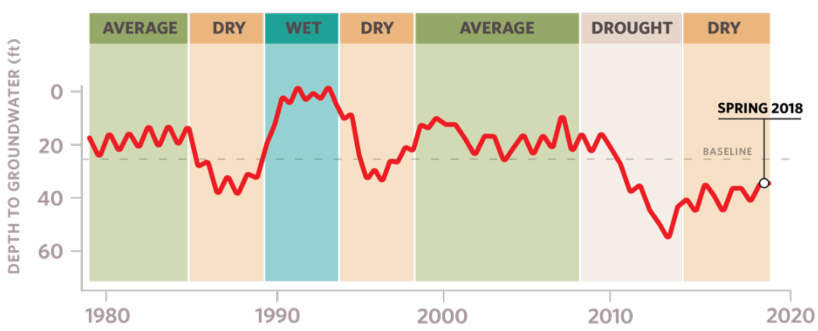

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[10] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[11] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[12] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[13] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[14], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

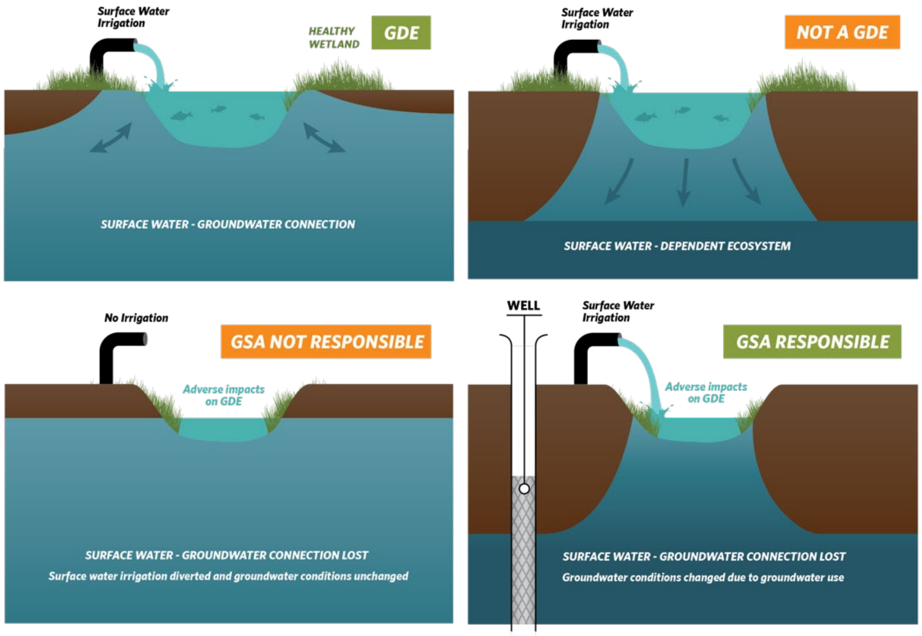

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[14] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

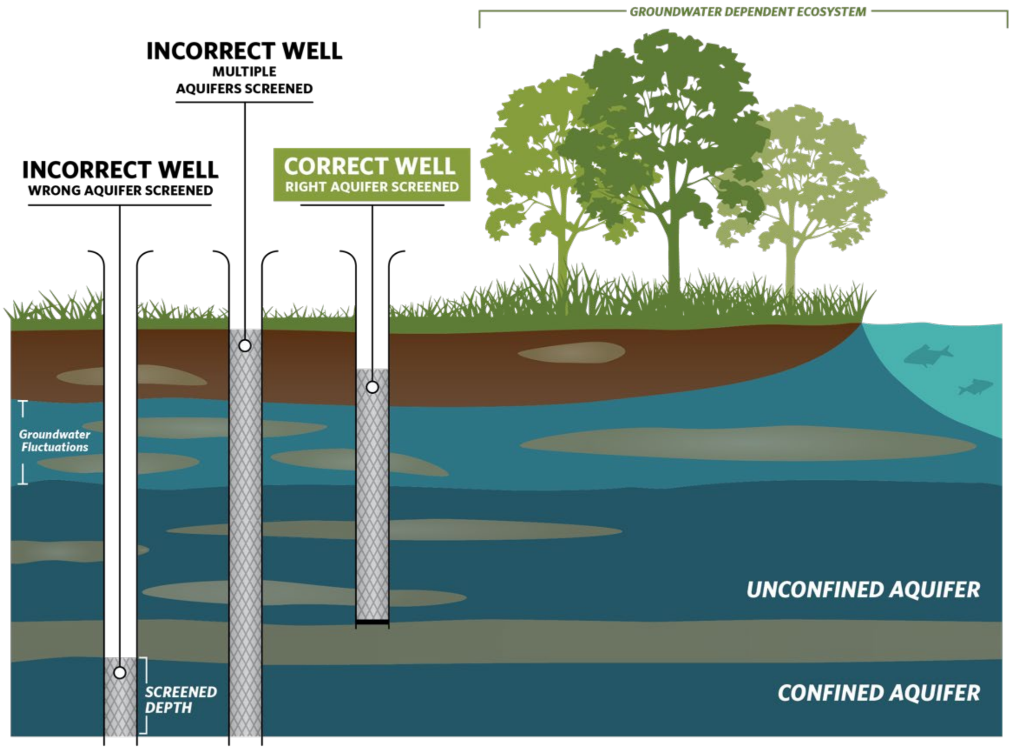

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[15] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

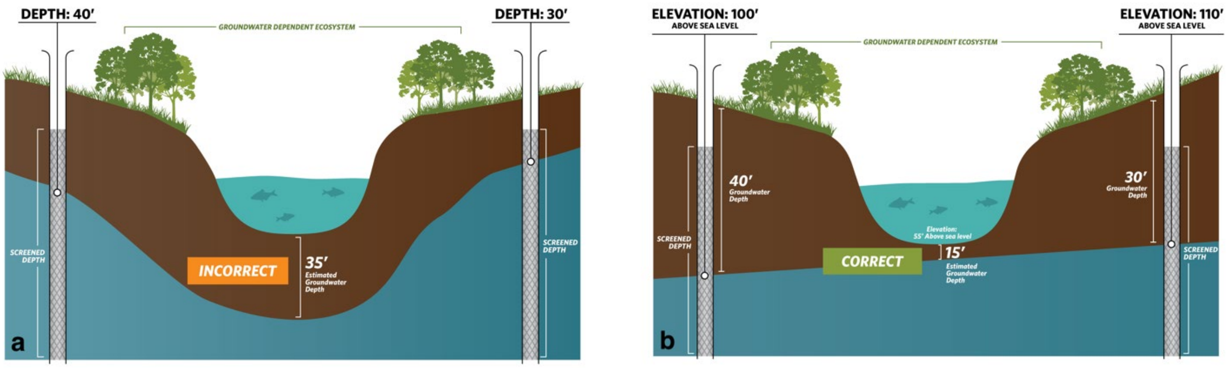

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

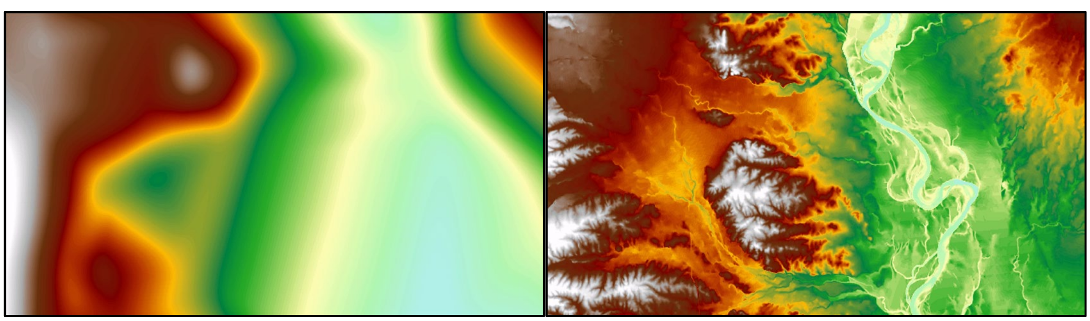

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[15] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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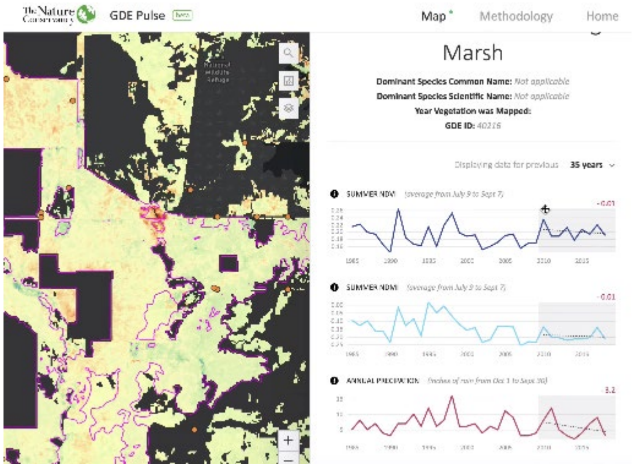

Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[16]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[17]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[16] *The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#*

[17] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[18]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[19]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[20] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[18] https://www.ncbi.nlm.nih.gov/pubmed/12753220
[19] Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009
[20] Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015

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May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Oxnard Subbasin Groundwater Sustainability Plan (GSP)

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Fox Canyon Groundwater Management Agency's (FCGMA) Oxnard Subbasin Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing *sustainable* groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be sufficient in addressing environmental beneficial uses and users.

We would like to compliment the GSA for their treatment of environmental beneficial users in the GSP. We believe the GSA sufficiently addressed environmental beneficial users in this first GSP submission. In the spirit of continual improvement embedded in SGMA, we would like to offer the following input as areas for improvement in the next version of the GSP.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data.

<u>Our Key Considerations</u>

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We would like to commend the GSA for incorporating our feedback, indicating strong engagement of environmental beneficial users. In addition, we would like to commend the GSA for including an environmental representative, a TNC staff member, on the Technical Advisory Group (TAG) throughout the GSP development. This inclusion led to a high degree of engagement in the GSP process. The quality of the plan benefitted from the ad hoc TAG subcommittee that was formed to evaluate GDEs in the subbasin. The impact of this group extends beyond this GSP because their efforts helped to develop a GDE guidance document that is now being used by dozens of GSAs across the state. In addition, a special TAG public workshop was convened to discuss GDEs and solicit input from the public. TNC, many other environmental non-governmental organizations (NGOs), and federal resource agency provided feedback on the draft GSP, indicating strong engagement of environmental beneficial users. To ensure the plan is well implemented, we hope the GSA will continue to engage stakeholders to prioritize and develop management actions, as well as make plan improvements as data becomes available.

Interconnected Surface Waters (ISWs) – The GSP took steps towards identifying ISWs, however improvements should be made to identify environmental users of surface water, gaining and losing reaches, and/or to account for the spatial and temporal variations in stream depletions that are inherent with California's Mediterranean climate. These components are necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). Specifically, we disagree with the statements that there are limited groundwater elevation data for the semi-perched aquifer in the Oxnard Subbasin. These data, including well elevation data dating back to 1990, have been described in TNC's Technical Memorandum: Assessment of Groundwater Dependent Ecosystems for the Oxnard Subbasin Groundwater Sustainability Plan (Appendix K of the GSP). There have been previous efforts to assess the quantity and timing of ISWs and groundwater by other consultants working at or nearby the surface water bodies, such as shallow monitoring data and groundwater modeling at Naval Base Ventura County from site-specific groundwater investigations and surface water and groundwater monitoring data at the Santa Clara River estuary and lower floodplain. These data were utilized and included in TNC's Technical Memorandum. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 1,966 acres of potential GDEs occur in the GSA boundary. TNC developed the Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

We would like to applaud the GSA for appropriately identifying and mapping GDEs, and for considering GDEs throughout the plan as a beneficial user of groundwater. The GSP provided thoughtful characterization of GDEs in the Oxnard Subbasin, including using an earlier version of the statewide database of GDE indicators (iGDE v0.3.1; TNC, 2017) and TNC's GDE Guidance document (Rohde et al., 2018). In addition to the mapping of basin GDEs, it also includes an assessment of the hydrologic and ecological conditions of the potential GDEs.

[1] Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

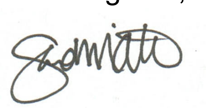
Water Budget – We would like to commend the GSP for including the groundwater demands of native vegetation and managed wetlands in the historical, current and projected water budgets.

Sustainable Management Criteria – We appreciate that the GSP includes and considers environmental beneficial uses and users of groundwater within the Sustainable Management Criteria. FCGMA Board of Directors adopted planning goals in 2015 that "Promote water levels that mitigate or minimize undesirable results (including pumping trough depressions, **surface water connectivity** [emphasis added], and chronic lowering of water levels)." Under current and known future conditions, as described in Section 3.3.6, the sustainability goal does not require inclusion of sustainability criteria for surface water connectivity. We agree this a reasonable position for the GSP *at this time*, given that the semi-perched aquifer is not currently managed for water supply. However, if future projects are envisioned to produce water from the semi-perched aquifer, sustainability criteria must be developed, since it is a principal aquifer, which is defined as "an aquifer that stores, transmits, and yields significant or economic quantities of groundwater to wells, springs, or surface water systems" [23 CCR § 351(aa)].

Monitoring Network – We would like to commend the GSP for developing a monitoring network that adequately characterizes the interaction of GDEs and other environmental beneficial users of surface water and groundwater. The GSP notes the lack of shallow groundwater monitoring wells in the semi-perched aquifer to monitor ISWs and GDEs along the Lower Santa Clara River, McGrath Lake, Ormond Beach and Mugu Lagoon, and potential GDEs along the Revolon Slough and Lower Calleguas Creek. We support the inclusion of monitoring wells within the potential GDEs to better assess the potential connectivity. A number of wells are in the vicinity of the GDEs and are already monitored by other agencies for specific remediation cases or regional studies. These should be included in the GSP. Making use of these existing monitoring wells provides long-term historical records, shares the burden of monitoring and provides important data at no cost to the GSA.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but *sustainable* groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,



Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Groundwater Sustainability Plan for the Oxnard Subbasin

The complete Final GSP for the Oxnard Subbasin, adopted December 13, 2019 as Resolution 19-05, was reviewed by TNC. TNC submitted comments on the Public Draft GSP on September 17, 2019. However, specific responses to comments on the Public Draft were not publicly available so we compared the Public Draft GSP to the Final GSP to determine if changes were made to the Final GSP text that addressed TNC's previously submitted comments. This attachment lists our original comments on the complete Public Draft GSP, as submitted to the FCGMA during the public comment period, and states whether or not they were addressed in the Final GSP [as green text in brackets]. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

[Section 1.8.2 Summary of Beneficial Uses and Users (pp. 1-45 to 1-46)]

- *[Our comment was not addressed. No changes to GSP text made.]* The GSP identifies the primary environmental users in the Oxnard Subbasin as the identified GDEs described in Section 2.3.7, and includes aquatic habitat, in-channel wetlands, riparian forest, and coastal marshes. The GSA has included representation of environmental users on their Technical Advisory Group (TAG) in a special meeting on GDEs, and in GSP email and meeting notifications. Our suggestion is to explicitly list different types of beneficial uses and users of groundwater under each category. This would better clarify who these beneficial uses and users are in the basin. In regards to EBUs, we recommend that GDEs identified in the Basin Setting section (i.e., the lower Santa Clara River, McGrath Lake, Ormond Beach wetlands, Mugu Lagoon, Calleguas Creek, and Revolon Slough) be *specifically* listed, as well as the RWQCB surface water EBUs within GDEs listed in Section 2.3.7 (e.g., fish migration and wildlife habitat). The identified GDEs are inclusive of a variety of plant and animal species; some of which are recognized as state or federally threatened and endangered or special-status species and are designated critical habitat.

  We also recommend that the GSP specifically engage with the natural resource agencies, NOAA's National Marine Fisheries Service (NMFS), United States Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), as stakeholders since they are important parties representing the public trust. In particular, the efforts to address the habitat needs of endangered species such as the endangered Southern California Steelhead in the development of the Multiple Species Habitat Conservation Plan (HCP) is of particular importance. We suggest that NMFS be consulted to ensure the GSP addresses the ecological needs as represented by these public trust agencies.

- *[Our comment has been adequately addressed through GSP text changes. Thank you for making this change that promotes better delineation of native habitat and its environmental value.]* *In Table 1-8*, please revise the Land Use Category from "Vacant" to "Open Space". As noted in Section 1.3.2.3 - Historical, Current, and Projected Land Use and Section 1.6.1 – General Plans, this is a substantial acreage that is valued highly in Ventura County as open space, with ordinances such as the 1998 Save Open Space and Agricultural Resources ordinance. We need to do a better job of delineating open space and native habitat from the "vacant" category, as this devalues the environment and its water need.

Checklist Items 2 to 3 - Description of Plan Area [(23 CCR §354.8)

[Section 1.4.3 Operational Flexibility Limitations (p. 1-19 to 1-20)]

- *[Our comment has been adequately addressed through GSP text changes.]* A Multiple Species HCP prepared by United Water Conservation District (UWCD) specifies flow conditions at the Freeman Diversion to be constrained by the habitat requirements for the federally endangered Southern California steelhead (Oncorhynchus mykiss) in the Santa Clara River.

Checklist Items 6 and 7 - Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 2.2.3 Principal Aquifers and Aquitards (pp.2-6 to 2-7), with additional detail in Sections 1.3.2.1, 2.3.6, 2.3.7, 2.4.1.1, 2.4.2.5 and Appendix K]

- *[No response required. No changes to GSP text made.]* The Hydrogeologic Conceptual Model adequately describes the shallow groundwater that is interconnected with surface waters and GDEs. Basin-wide cross sections provided in Figures 2-3 and 2-4 include a graphical representation of the manner in which shallow groundwater may interact with ISWs or GDEs that would allow the reader to understand this topic. In the Oxnard Subbasin, the shallow groundwater unit and semi-perched aquifer, is connected to surface waters (e.g., Santa Clara River, Calleguas Creek, Revolon Slough, McGrath Lake, and the coastal wetlands at Ormond Beach and Mugu Lagoon). The semi-perched aquifer is not considered a principal aquifer due to its limited groundwater production (<50 AFY).

Checklist Items 8, 9 and 10 – Interconnected Surface Water (ISW) (23 CCR §354.16)

[Sections 1.3.2.1, 2.3.6, 2.3.7, 2.4.1.1, 2.4.2.5 and Appendix K (TNC GDE Tech Memo)]

- *[Our commend was not addressed. No changes to GSP text made.]* The Santa Clara River, Calleguas Creek, Revolon Slough, Mugu Lagoon, Ormond Beach, and McGrath Lake have all been identified as surface water bodies that may have a connection to the semi-perched aquifer in the Oxnard Subbasin. Qualitative statements are made regarding the interconnectedness, including gaining/losing reaches, and timing are provided, along with quantification, based on numerical modeling, of the recharge to groundwater from the Santa Clara River and Calleguas Creek.

We disagree with the qualifying statements that the "surface water bodies that may have a connection" and "However, groundwater elevation data for the semi-perched aquifer in the Oxnard Subbasin are extremely limited, with no monitoring sites near enough to surface water bodies to establish the extent of the connection between these surface water bodies and underlying groundwater." There have been previous efforts to assess the quantity and timing of interconnected surface water and groundwater by other consultants working at or nearby the surface water bodies, such as shallow monitoring data and groundwater modeling at Naval Base Ventura County from site-specific groundwater investigations and surface water and groundwater monitoring data at the Santa Clara River estuary and lower floodplain. These data, including well elevation data dating back to 1990, have been described in TNC's Technical Memorandum: Assessment of Groundwater Dependent Ecosystems for the Oxnard Subbasin Groundwater Sustainability Plan (Appendix K). TNC's assessment of these reports indicate that the water elevation data and analyses corroborate the conceptual model that groundwater levels in the semi-perched aquifer relatively constant with a seasonal cyclical behavior, although there has been a downward trend with the recent (2011-16) drought. These reports and data provide estimates of quantity and timing of groundwater - surface water interactions. The GSA should review said reports and data and revise these statements to be definitive statements of the connections of surface water and groundwater.

<u>Checklist Items 11 to 20 - Identification, Mapping and Description of GDEs (23 CCR §354.16)</u>

[Section 2.3.7 Groundwater-Dependent Ecosystems (pp. 2-43 – 2-46) and Appendix K]

- *[No response required. No changes to GSP text made.]* GDEs have been identified and mapped during the GSP development process using an earlier version of the statewide database of GDE indicators (iGDE v0.3.1; TNC, 2017) and TNC's GDE Guidance document (Rohde et al., 2018). This evaluation is described in Appendix K, with a brief summary in Section 2.3.7. In addition to the mapping of basin GDEs, it also includes both an assessment of the hydrologic and ecological conditions of the GDEs and potential GDEs.

[Executive Summary (p. 1-1) and Section 1.1 Purpose of the Groundwater Sustainability Plan (p.1-2)]

- *[No response required. No changes to GSP text made.]* While we support the position that "Depletions of interconnected surface water have not occurred historically in the Subbasin, because the Groundwater-Dependent Ecosystems (GDEs) in the Subbasin are supported by shallow groundwater flows that are generally separated and disconnected from the primary groundwater aquifers," we would like to make this clear that historical conditions represent the time period referenced by SGMA – since the 1980s. As noted in Section 2.2.3, once agriculture grew in the Oxnard Subbasin, groundwater levels in the semi-perched aquifer were lowered using the agricultural tile drains (installed in the 1900s) for drainage of irrigated water from the agricultural fields.

Checklist Items 21 and 22 - Water Budget (23 CCR §354.18)

[Section 2.4 Water Budget]

- *[No response required. No changes to GSP text made.]* The water budget now includes the semi-perched aquifer and the surface hydrologic components of the semi-perched aquifer, including the groundwater-surface water exchanges with the Santa Clara River and the Calleguas Creek and natural vegetation evapotranspiration (ET). We appreciate the separate inclusion of the semi-perched aquifer water budget.

Checklist Items 23 to 25 - Sustainability Goal (23 CCR §354.24)

[Section 3.1 Introduction to Sustainable Management Criteria (p. 3-1)]

- *[No response required. No changes to GSP text made.]* FCGMA Board of Directors adopted planning goals in 2015 that "Promote water levels that mitigate or minimize undesirable results (including pumping trough depressions, **surface water connectivity** [emphasis added], and chronic lowering of water levels)."

  Under current and known future conditions, as described in Section 3.3.6, the sustainability goal does not require inclusion of sustainability criteria for surface water connectivity. We agree this as reasonable position for the GSP *at this time*, given that the semi-perched aquifer is not managed for water supply. However, if future projects are envisioned to produce water from the semi-perched aquifer, sustainability criteria should be developed.

Checklist Items 30 to 46 - Undesirable Results (23 CCR §354.26)

[Section 3.3.6 Depletions of Interconnected Surface Water (p. 3-10 - 3-11)]

- *[No response required. No changes to GSP text made.]* The GSP clearly states: "The undesirable result associated with depletion of interconnected surface water in the Oxnard Subbasin is loss of groundwater-dependent ecosystem (GDE) habitat." We applaud this clear recognition of GDEs as an important beneficial use that must be protected. We also agree with further statements that 1) undesirable results are not currently occurring, 2) groundwater elevation monitoring will continue to be monitored in the semi-perched aquifer, and 3) if future projects involve the use of the semi-perched aquifer, then "depletion of interconnected surface water is possible, and significant and unreasonable impacts may occur." While we agree that "Reevaluation of the effects on existing and potential GDEs should be conducted in conjunction with the project approval process for any such future projects," we urge stronger language to specifically state sustainability criteria will be developed at that future time.

Checklist Items 27 to 29 - Minimum Thresholds (23 CCR §354.28)

[Section 3.4.6 Minimum Thresholds – Depletions of Interconnected Surface Water (pp. 3-19 to 3-20)]

- *[No response required. No changes to GSP text made.]* We applaud the language recognizing that future projects may have a potential impact on ISWs and GDEs, and that "if projects that produce groundwater from the semi-perched aquifer are implemented, the need for specific water level minimum thresholds in the semi-perched aquifer should be reevaluated".

  This section defines minimum thresholds due to salinity front as the modeling shows Upper Aquifer System (UAS) levels support the groundwater elevations in the semi-perched aquifer. This is confusing as it seems like the recharge is predominantly downwards from the semi-perched aquifer to the UAS. It is unclear how the UAS is influencing the salinity front in the semi-perched aquifer.

Checklist Item 26 - Measurable Objectives (23 CCR §354.30)

[Section 3.5.6 Measurable Objectives – Depletions of Interconnected Surface Water (pp. 3-26 to 3-27)]

- *[We applaud the inclusion of the suggestion listed in our comments.]* A measurable objective for ISWs in the semi-perched aquifer is set to address seawater intrusion. We recommend adding a statement, as is done in Section 3.4.6, that "if projects that produce groundwater from the semi-perched aquifer are implemented, specific water level measurable objectives in the semi-perched aquifer should be developed".

Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)

[Section 4.3.6 Depletions of Interconnected Surface Water (p. 4-10)]

- *[Our comment was not addressed. No changes to GSP text made.]* We recommend including remote sensing vegetative indices as a low-cost approach to monitor baseline conditions of GDEs. TNC's free online tool, GDE Pulse, allows GSAs a way to assess changes in GDE health using remote sensing data sets; specifically, the Normalized Difference Vegetation Index (NDVI), which is a satellite-derived index that represents the greenness of vegetation and Normalized Difference Moisture Index (NDMI), which is a satellite-derived index that represents water content in vegetation.

[Section 4.6.5 Shallow Groundwater Monitoring near Surface Water Bodies and GDEs (p. 4-15)]

- *[Our comment was not addressed. No changes to GSP text made.]* The GSP notes the lack of shallow groundwater monitoring wells in the semi-perched aquifer that can be used to monitor ISWs and GDEs along the Lower Santa Clara River, McGrath Lake, Ormond Beach and Mugu Lagoon, and potential GDEs along the Revolon Slough and Lower Calleguas Creek in the Subbasin. We support the inclusion of monitoring wells within the potential GDEs to better assess the potential connectivity. A number of wells are in the vicinity of the GDEs and are monitored by other agencies for specific remediation cases or regional studies. These should be included in the GSP. It is to the benefit of the GSA to make use of these existing monitoring wells as they provide long-term historical records and are already monitored by other agencies and are available at no cost to the GSA. The data have been made available for the GSP and it is recommended that monitoring agreements be put in place to receive ongoing data on these wells and ensure the long-term monitoring continues. In particular, we suggest the following wells to serve as representative monitoring wells for each GDE in order to monitor impacts caused by depletions of ISWs (Figures 6-9, Appendix K):

GDE	**Well**
Lower Santa Clara River	2N22W30A03S
McGrath Lake	GW-3
Ormond Wetlands	01N22W27G04S
Mugu Lagoon	MW6-6A

[Section 4.6.6 Surface Water: Flows in Agricultural Drains in the Oxnard Plain (pp. 4-15 to 4-16)]

- *[Our comment was not addressed. No changes to GSP text made.]* We would also recommend that surveying the water surface elevation in the drains, as they should be easy to measure, provide calibration head values for the numerical model and be a good indication of the semi-perched aquifer elevations.

Checklist Items 50 and 51 - Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)

[Section 5.8 Management Action No. 2 – Water Market Pilot Program (pp. 5-17 to 5-18)]

- *[No response required. No changes to GSP text made.]* The GSP indicates that significant reductions in groundwater extractions will be needed to avoid undesirable results. These reductions may have serious impacts on existing extractors. We support development and implementation of a well-designed water market that will incentivize conservation and provide flexibility for pumpers in meeting the objectives of the GSP. The water market must have rules that prevent negative impacts to other beneficial users such as the environment and Disadvantaged Communities.

Attachment C

Freshwater Species Located in the Oxnard Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Oxnard Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[2]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the CDFW's BIOS[3] as well as on TNC's science website[4].

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	BCC	SSC	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		SSC	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		SSC	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			

[2] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[3] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[4] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		SSC	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	BCC	SSC	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	BCC	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	BCC	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Histrionicus histrionicus	Harlequin Duck		SSC	BSSC - Second priority
Icteria virens	Yellow-breasted Chat		SSC	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oreothlypis luciae	Lucy's Warbler		SSC	BSSC - Third priority
Oxyura jamaicensis	Ruddy Duck			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Pelecanus erythrorhynchos	American White Pelican		SSC	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Pipilo aberti	Abert's Towhee			
Piranga rubra	Summer Tanager		SSC	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Rynchops niger	Black Skimmer			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		SSC	BSSC - Third priority
CRUSTACEANS				
Americorophium spp.	Americorophium spp.			
Cambaridae fam.	Cambaridae fam.			
Cyprididae fam.	Cyprididae fam.			
Gammarus spp.	Gammarus spp.			
Hyalella spp.	Hyalella spp.			
FISH				
Catostomus santaanae	Santa Ana sucker	Threatened	SSC	Endangered - Moyle 2013
Eucyclogobius newberryi	Tidewater goby	Endangered	SSC	Vulnerable - Moyle 2013
Gasterosteus aculeatus williamsoni	Unarmored threespine stickleback	Endangered	Endangered	Endangered - Moyle 2013
Oncorhynchus mykiss - Southern CA	Southern California steelhead	Endangered	SSC	Endangered - Moyle 2013
HERPS				

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Actinemys marmorata marmorata	Western Pond Turtle		SSC	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Pseudacris cadaverina	California Treefrog			ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
Rana draytonii	California Red-legged Frog	Threatened	SSC	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	SSC	ARSSC
Taricha torosa	Coast Range Newt		SSC	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		SSC	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTEBRATES				
Abedus spp.	Abedus spp.			
Ablabesmyia spp.	Ablabesmyia spp.			
Aeshnidae fam.	Aeshnidae fam.			
Ambrysus spp.	Ambrysus spp.			
Anax junius	Common Green Darner			
Baetis spp.	Baetis spp.			
Berosus spp.	Berosus spp.			
Callibaetis spp.	Callibaetis spp.			
Centroptilum album	A Mayfly			
Centroptilum spp.	Centroptilum spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus anonymus				Not on any status lists
Chironomus spp.	Chironomus spp.			
Cladotanytarsus marki				Not on any status lists
Cladotanytarsus spp.	Cladotanytarsus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corisella decolor				Not on any status lists
Corixidae fam.	Corixidae fam.			
Cricotopus annulator				Not on any status lists
Cricotopus bicinctus				Not on any status lists
Cricotopus spp.	Cricotopus spp.			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Cryptochironomus spp.	Cryptochironomus spp.			
Dicrotendipes adnilus				Not on any status lists
Dicrotendipes spp.	Dicrotendipes spp.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Ephydridae fam.	Ephydridae fam.			
Eukiefferiella claripennis				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Hetaerina americana	American Rubyspot			
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Hygrotus spp.	Hygrotus spp.			
Laccobius spp.	Laccobius spp.			
Leptoceridae fam.	Leptoceridae fam.			
Libellula comanche	Comanche Skimmer			
Libellula spp.	Libellula spp.			
Limnophyes spp.	Limnophyes spp.			
Microcylloepus spp.	Microcylloepus spp.			
Micropsectra nigripila				Not on any status lists
Micropsectra spp.	Micropsectra spp.			
Microtendipes caducus				Not on any status lists
Microtendipes spp.	Microtendipes spp.			
Nectopsyche spp.	Nectopsyche spp.			
Ochthebius apache				Not on any status lists
Ochthebius spp.	Ochthebius spp.			
Optioservus spp.	Optioservus spp.			
Orthocladius appersoni				Not on any status lists
Orthocladius spp.	Orthocladius spp.			
Oxyethira spp.	Oxyethira spp.			
Paratanytarsus grimmii				Not on any status lists
Paratanytarsus spp.	Paratanytarsus spp.			
Peltodytes spp.	Peltodytes spp.			
Pentaneura inconspicua				Not on any status lists
Pentaneura spp.	Pentaneura spp.			
Phaenopsectra spp.	Phaenopsectra spp.			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Polypedilum albicorne				Not on any status lists
Polypedilum spp.	Polypedilum spp.			
Postelichus spp.	Postelichus spp.			
Procladius barbatulus				Not on any status lists
Procladius spp.	Procladius spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Pseudosmittia forcipata				Not on any status lists
Pseudosmittia spp.	Pseudosmittia spp.			
Psychodidae fam.	Psychodidae fam.			
Rheotanytarsus hamatus				Not on any status lists
Rheotanytarsus spp.	Rheotanytarsus spp.			
Simulium anduzei				Not on any status lists
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Stictotarsus spp.	Stictotarsus spp.			
Tanytarsus angulatus				Not on any status lists
Tanytarsus spp.	Tanytarsus spp.			
Tipulidae fam.	Tipulidae fam.			
Trichocorixa arizonensis				Not on any status lists
Trichocorixa spp.	Trichocorixa spp.			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus spp.	Tropisternus spp.			
MAMMALS				
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Lymnaea spp.	Lymnaea spp.			
Physa acuta	Pewter Physa			Not on any status lists
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
PLANTS				
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla filiculoides	NA			
Baccharis salicina				Not on any status lists
Batis maritima	Saltwort			
Berula erecta	Wild Parsnip			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Bidens laevis	Smooth Bur-marigold			
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Bolboschoenus robustus				Not on any status lists
Chloropyron maritimum maritimum		Endangered	Endangered	CRPR - 1B.2
Cotula coronopifolia	NA			
Cyperus involucratus	NA			
Distichlis littoralis	NA			Not on any status lists
Eleocharis montevidensis	Sand Spikerush			
Eleocharis parishii	Parish's Spikerush			
Euthamia occidentalis	Western Fragrant Goldenrod			
Helenium puberulum	Rosilla			
Hydrocotyle umbellata	Many-flower Marsh-pennywort			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Jaumea carnosa	Fleshy Jaumea			
Juncus acutus leopoldii	Spiny Rush		SSC	CRPR - 4.2
Juncus rugulosus	Wrinkled Rush			
Juncus textilis	Basket Rush			
Lasthenia glabrata coulteri	Coulter's Goldfields		SSC	CRPR - 1B.1
Limonium californicum	California Sea-lavender			
Ludwigia peploides peploides	NA			Not on any status lists
Myriophyllum aquaticum	NA			
Phacelia distans	NA			
Pluchea odorata odorata	Scented Conyza			
Potamogeton foliosus foliosus	Leafy Pondweed			
Potentilla anserina pacifica				Not on any status lists
Rumex crassus				Not on any status lists
Rumex fueginus				Not on any status lists
Rumex salicifolius salicifolius	Willow Dock			
Ruppia cirrhosa	Widgeon-grass			
Ruppia maritima	Ditch-grass			
Salicornia bigelovii	Dwarf Glasswort			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Salix exigua exigua	Narrowleaf Willow			
Salix exigua hindsiana				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus americanus	Three-square Bulrush			
Schoenoplectus californicus	California Bulrush			
Solidago spectabilis	Nevada Goldenrod			
Spartina foliosa	California Cordgrass			
Suaeda calceoliformis	American Sea-blite			
Suaeda californica	California Sea-blite	Endangered	SSC	CRPR - 1B.1
Suaeda esteroa	Estuary Suaeda		SSC	CRPR - 1B.2
Triglochin maritima	Common Bog Arrow-grass			
Triglochin striata	Three-ribbed Arrow-grass			
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica americana	American Speedwell			
Veronica anagallis-aquatica	NA			
Notes: ARSSC = At-Risk Species of Special Concern BCC = Bird of Conservation Concern BSSC = Bird Species of Special Concern CRPR = California Rare Plant Rank IUCN = International Union for Conservation of Nature SSC = Species of Special Concern				

Attachment D

July 2019

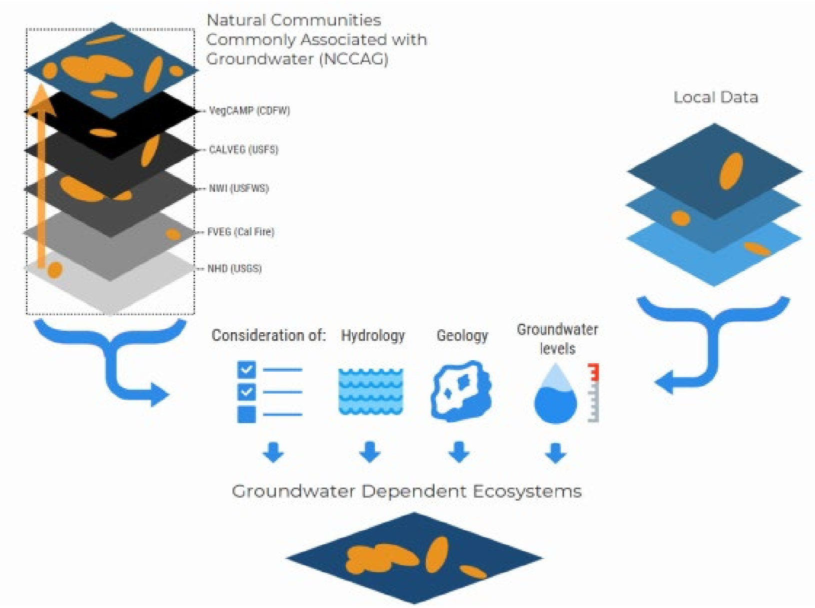
IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[5] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[6]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

[5] *NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/*

[6] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf



The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[7]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[8] on the Groundwater Resource Hub[9], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may

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[7] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[8] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[9] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

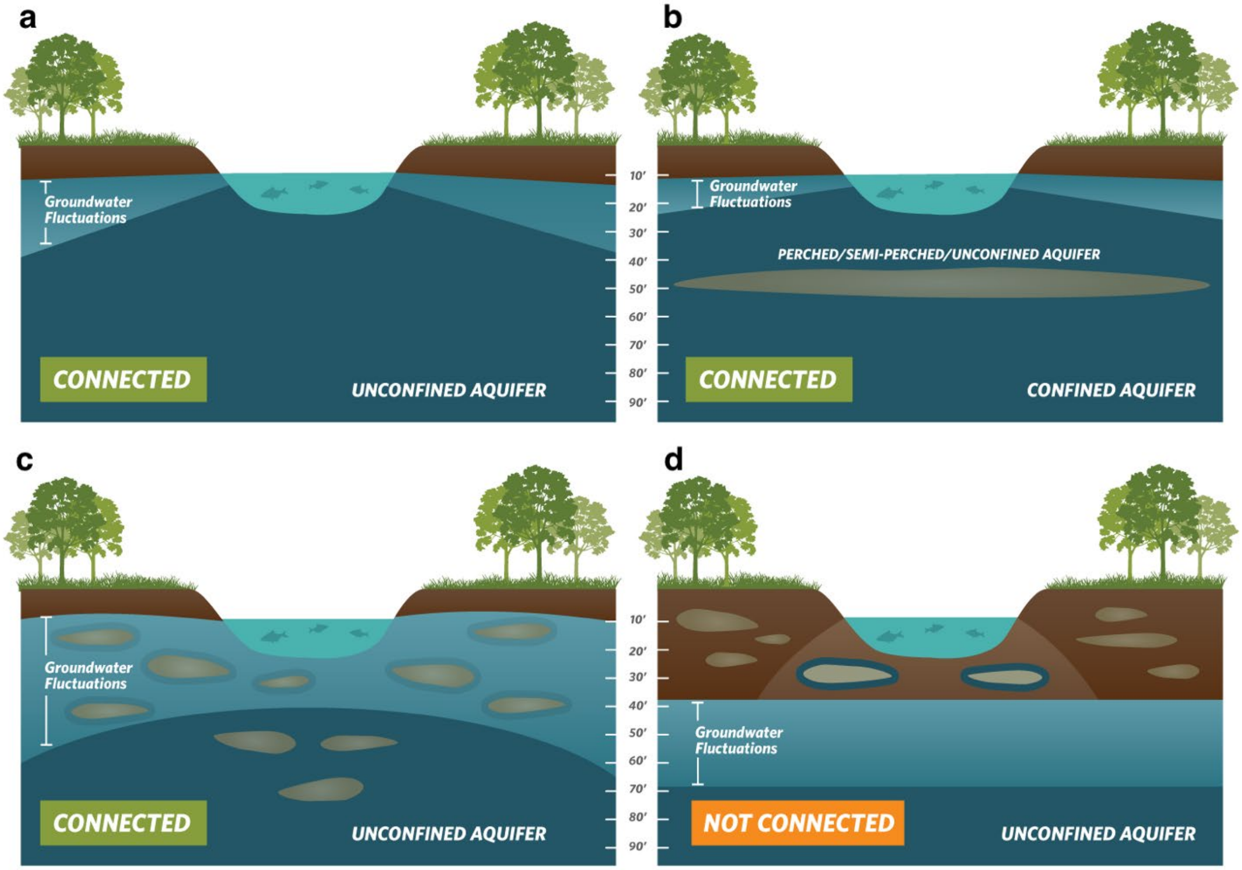

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[10] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[11] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[12] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[13]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

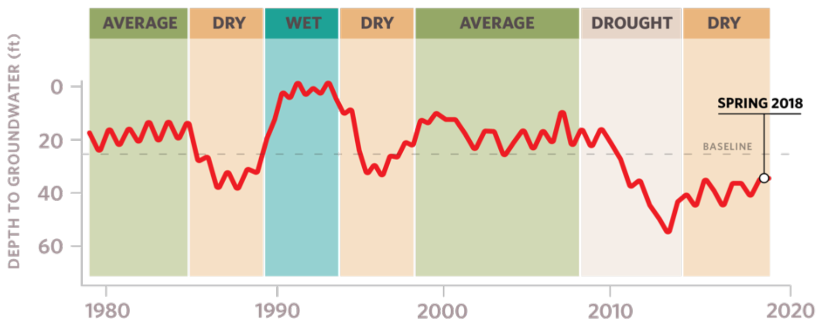

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[10] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[11] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[12] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[13] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[14], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

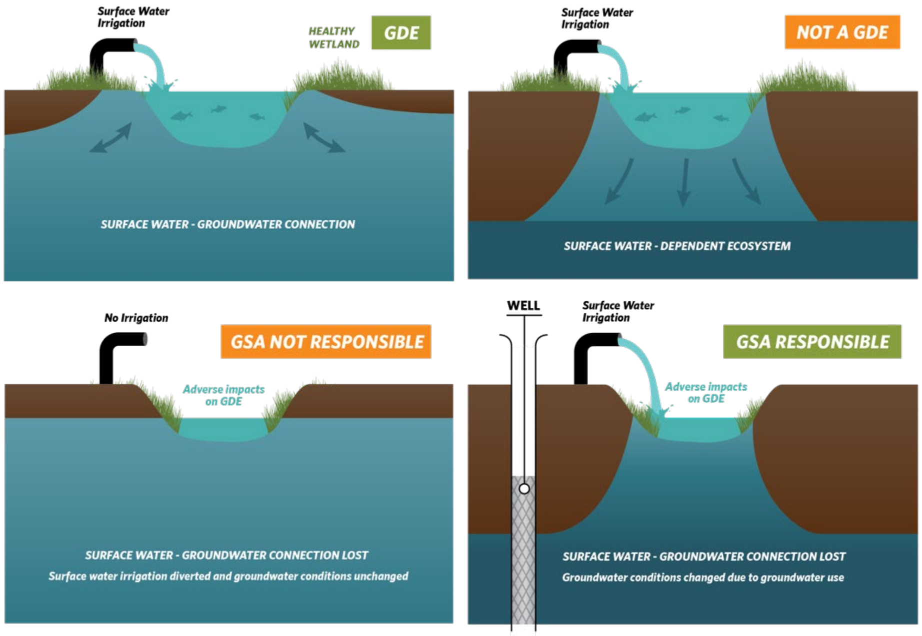

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[14] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

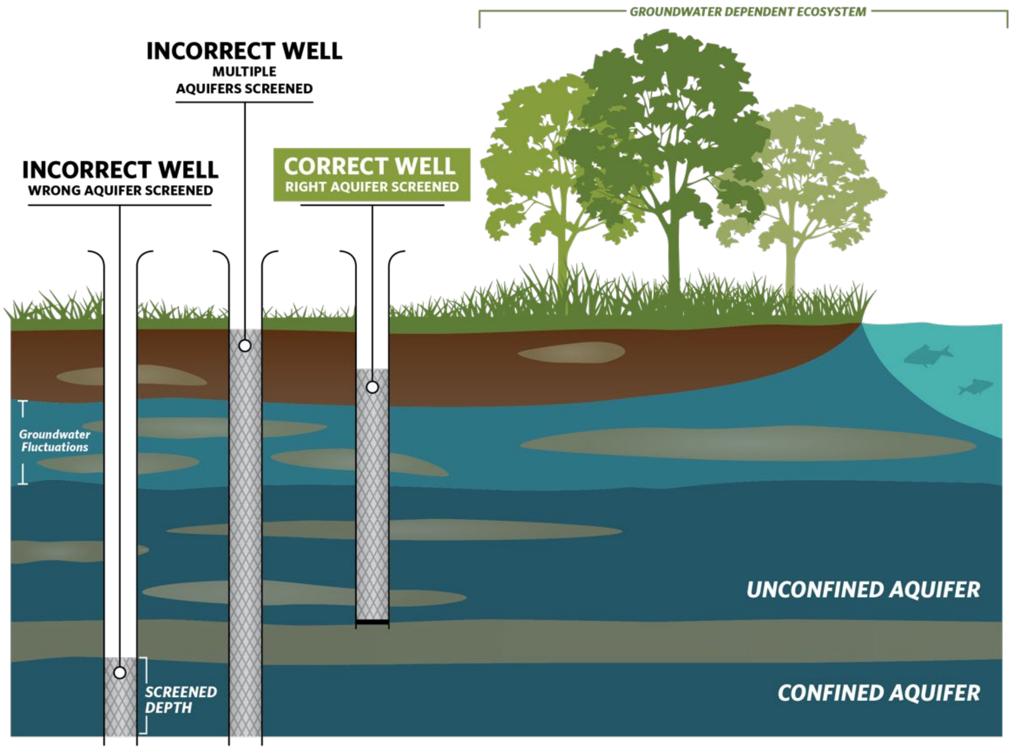

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[15] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

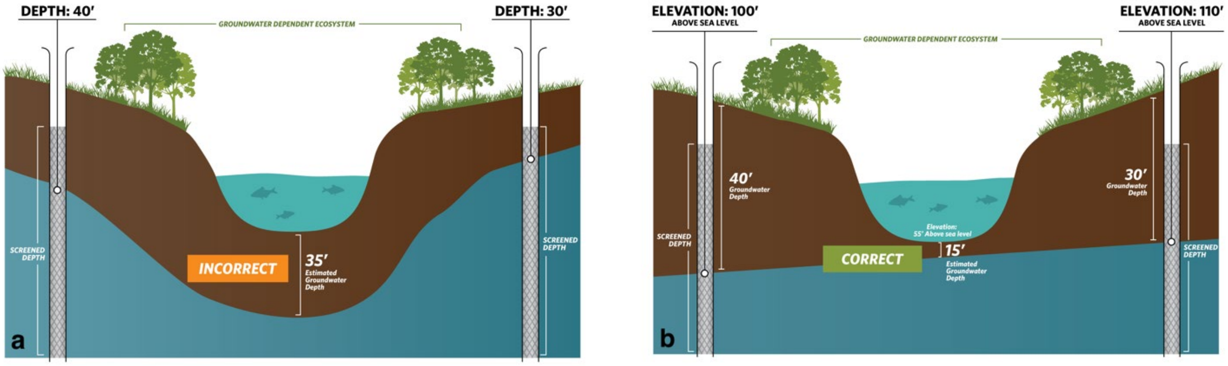

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

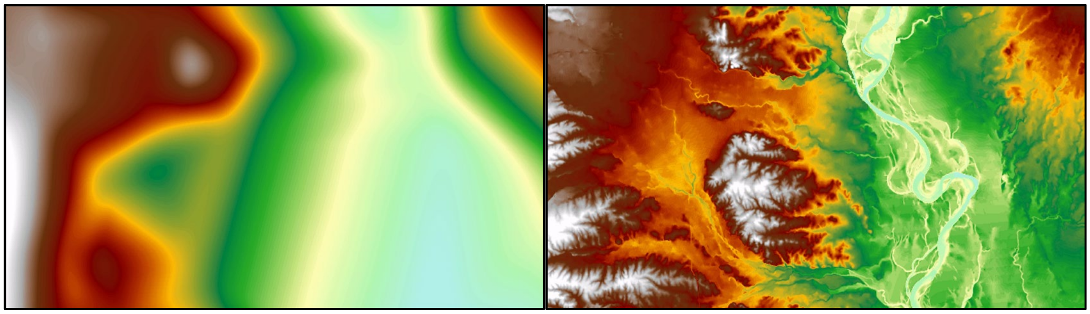

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[15] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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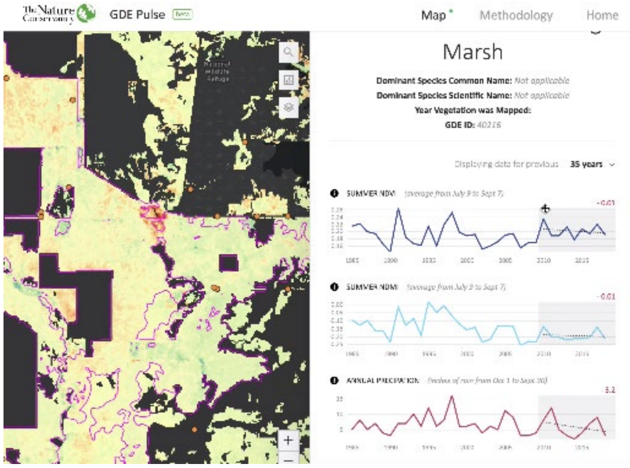
Visit
https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[16]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[17]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[16] *The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#*

[17] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[18]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[19]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[20] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

[18] https://www.ncbi.nlm.nih.gov/pubmed/12753220
[19] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[20] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Pleasant Valley Basin Groundwater Sustainability Plan (GSP)

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Fox Canyon Groundwater Management Agency's Pleasant Valley Basin Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing *sustainable* groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be sufficient in addressing environmental beneficial uses and users.

We would like to compliment the GSA for their treatment of environmental beneficial users in the GSP. We believe the GSA sufficiently addressed environmental beneficial users in this first GSP submission. In the spirit of continual improvement embedded in SGMA, we would like to offer the following input as areas for improvement in the next version of the GSP.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We would like to commend the GSA for incorporating our feedback, indicating strong engagement of environmental beneficial users. In addition, we would like to commend the GSA for including an environmental representative, a TNC staff member, on the Technical Advisory Group (TAG) throughout the GSP development. This inclusion led to a high degree of engagement in the GSP process. The quality of the plan benefitted from the ad hoc TAG subcommittee that was formed to evaluate GDEs in the subbasin. The impact of this group extends beyond this GSP because their efforts helped to develop a GDE guidance document that is now being used by dozens of GSAs across the state. In addition, a special TAG public workshop was convened to discuss GDEs and solicit input from the public. TNC, many other environmental non-governmental organizations (NGOs), and federal resource agency provided feedback on the draft GSP, indicating strong engagement of environmental beneficial users. To ensure the plan is well implemented, we hope the GSA will continue to engage stakeholders to prioritize and develop management actions, as well as make plan improvements as data becomes available.

Interconnected Surface Waters - We are pleased to see that the GSP took steps to identify and map ISWs. Arroyo Las Posas, Conejo Creek, and Calleguas Creek have all been identified as surface water bodies that may have a connection to the Shallow Alluvial Aquifer in the Pleasant Valley Basin. It is recognized that Arroyo Las Posas is ephemeral in the Pleasant Valley Basin and is likely to be a disconnected losing stream, and Conejo Creek and Calleguas Creek are likely perennial due to wastewater treatment discharges. Numerical modeling estimates of annual quantification of recharge to groundwater from Arroyo Las Posas, Conejo Creek, and Calleguas Creek are provided in Section 2.3.6. However, while the model results list net recharge to groundwater via stream loss, the discussion in Sections 2.3.6 and 2.3.7 indicates there is insufficient knowledge to build a conceptual model of the extent of losing and gaining reaches. ISWs are defined as "surface water that is hydraulically connected *at any point* by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted." (23 CCR §351(o)), (emphasis added) "At any point" has both a spatial and temporal component. Even short durations of interconnection between groundwater and surface water can be crucial for surface water flow and support of wetlands. Until a disconnection can be proven, we recommend that potential ISWs be included in the plan.

Groundwater Dependent Ecosystems – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 301 acres of potential GDEs occur in the GSA boundary. TNC developed the Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

We would like to applaud the GSA for appropriately identifying and mapping GDEs, and for considering GDEs throughout the plan as a beneficial user of groundwater. The GSP provided

[1] Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

thoughtful characterization of Wetland GDEs and Vegetative GDEs in the Pleasant Valley Basin area, including using an earlier version of the statewide database of GDE indicators (iGDE v0.3.1; TNC, 2017) and TNC's GDE Guidance document (Rohde et al., 2018). In addition to the mapping of basin GDEs, it also includes 1) an assessment of the hydrologic and ecological conditions of the potential GDEs; and 2) TNC's comment letter to the draft GSP (as Appendix A-5 to the GSP), which includes the list of freshwater species included in Attachment C of this letter.

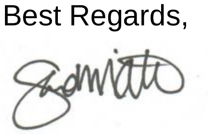
Water Budget – We would like to commend the GSP for including the groundwater demands of native vegetation and managed wetlands in the historical, current and projected water budgets.

Sustainable Management Criteria – We appreciate that the GSP includes and considers environmental beneficial uses and users of groundwater within the Sustainable Management Criteria. Fox Canyon Groundwater Management Agency (FCGMA) Board of Directors adopted planning goals in 2015 that "Promote water levels that mitigate or minimize undesirable results (including pumping trough depressions, **surface water connectivity** [emphasis added], and chronic lowering of water levels)." Under current and known future conditions, as described in Section 3.3.6, the sustainability goal does not require inclusion of sustainability criteria for surface water connectivity. We agree with this position given the uncertainty regarding the depths to groundwater as described in Section 2.3.3 and 2.3.7. Nevertheless, the criteria should be reevaluated in the future if future projects confirm the linkage between GDEs and ISWs or cause undesirable results.

Monitoring Network – We would like to commend the GSP for developing a monitoring network that adequately characterizes the interaction of GDEs and other environmental beneficial users of surface water and groundwater. The GSP notes the lack of shallow groundwater monitoring wells in the Shallow Alluvial Aquifer that can be used to monitor ISWs and GDEs along the Arroyo Las Posas. We do not think this is necessary for the Arroyo Las Posas. We recommend further investigation of the water level records in the younger alluvium that are available from shallow wells associated with groundwater remediation cases and made available on GeoTracker. If these water level records can demonstrate the groundwater connection, or lack thereof, then the data gap regarding connectivity can be closed.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but *sustainable* groundwater management that considers the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,



Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Pleasant Valley Basin Groundwater Sustainability Plan
Comments based on Draft and Final GSPs

The complete Final GSP for the Pleasant Valley Basin, adopted December 13, 2019 as Resolution 19-05, was reviewed by TNC. TNC submitted comments on the Public Draft GSP on September 17, 2019. However, specific responses to comments on the Public Draft were not publicly available, so we compared the Public Draft GSP to the Final GSP to determine if changes were made to the Final GSP text that addressed TNC's previously submitted comments. This attachment lists our original comments on the complete Public Draft GSP, as submitted to the Fox Canyon Groundwater Management Agency during the public comment period, and states whether or not they were addressed in the Final GSP [as green text within brackets]. Any change to the text of our draft comments will be displayed as red text. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

[Section 1.8.2 Summary of Beneficial Uses and Users (pp. 1-45 to 1-46)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* The GSP identifies the primary EBUs in the Pleasant Valley Basin as the willow/mulefat riparian scrub and arundo vegetation communities found along the banks of Conejo Creek, Calleguas Creek, lower Arroyo Las Posas, and Conejo Creeks. The degree to which these ecosystems use groundwater versus percolating surface water is uncertain. The GSA has included representation of environmental users on their Technical Advisory Group (TAG) in a special meeting on GDEs, and in GSP email and meeting notifications. We recommend that the GSP specifically list the natural resource agencies, such as the National Marine Fisheries Service, United States Fish and Wildlife Service (USFWS), and California Department of Fish and Wildlife (CDFW), as stakeholders since they are important parties representing the public trust. In addition, both the CDFW and the USFWS have attended the special TAG GDE meeting.

[Section 1.3.2.3 Historical, Current and Projected Land Use (Table 1-8) (p. 1-51)]

- *[Our comment has been adequately addressed through changes in the GSP text. The text in Table 1-8 was revised from Vacant to Open Space.]* Please revise the Land Use Category from "Vacant" to "Open Space". As noted in Section 1.3.2.3 - Historical, Current, and Projected Land Use and Section 1.6.1 – General Plans, this is a substantial acreage that is valued highly in Ventura County as open space, with ordinances such as the 1998 Save Open Space and Agricultural Resources ordinance. We need to do a better job of delineating open space and native habitat from the "vacant" category, as this devalues the environment and its water need.

Checklist Items 2 and 3 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8)

[Section 1.4.2 Operational Flexibility Limitations (pp. 1-19 to 1-20)]

- *[No changes to GSP text made.]* A Multiple Species Habitat Conservation Plan (HCP) prepared by United Water Conservation District (UWCD) specifies flow conditions at the Freeman Diversion to be constrained by the habitat requirements for the federally endangered Southern California steelhead (*Oncorhynchus mykiss*) in the Santa Clara River. These flow requirements and how may be affected and/or addressed by this GSP needs to be flushed out in the document.

Checklist Items 6 and 7 - Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 2.2.4 Principal Aquifers and Aquitards (pp. 2-6 to 2-7), with additional detail in Sections 1.3.2.1, 2.3.1.1, 2.3.6, 2.3.7, 2.4.1.1, 2.4.2.5, and Appendix K]

- *[No changes to GSP text made.]* Description & cross-sections are contradictory in presenting the extent of the Shallow Alluvial Aquifer. Also, it is not clear where the semi-perched and Shallow Alluvial aquifers are located in the discussion. Aerial extent maps should be included, and it made clear whether these are or are not principal aquifers.
- *[No changes to GSP text made.]* Section 2.2.4 describes the Shallow Alluvial Aquifer that is interconnected with surface waters (Arroyo Las Posas, Conejo Creek, and Calleguas Creek) and potential GDEs. The basin-wide cross sections provided in Figures 2-3 and 2-5 include a graphical representation of the manner in which shallow groundwater may interact with ISWs or GDEs that would allow the reader to understand this topic, though the representation doesn't match the text language in Section 2.3.1.1, which states "The Shallow Alluvial Aquifer comprises the **recent alluvial deposits** [emphasis added] that line Arroyo Las Posas, Arroyo Santa Rosa, Conejo Creek, and Calleguas Creek in the PVB". Also Figure 2-4 does not indicate presence of the Shallow Alluvial Aquifer in this area. Figure 2-2 shows the recent alluvium along Conejo Creek and lower part of Calleguas Creek, but the placement of the Shallow Alluvial Aquifer in the cross-section A-A' in Figure 2-3 doesn't quite match up. Including the locations of the Conejo and Calleguas Creeks would help clarify the understanding. It is also unclear where the semi-perched aquifer exists within the Pleasant Valley Basin. Neither the Shallow Alluvial Aquifer nor the semi-perched aquifer are considered principal aquifers in the Pleasant Valley Basin.

Checklist Items 8, 9, and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16); and Identification of ISWs is a required element of Current and Historical Groundwater Conditions (23 CCR §354.16)

[Sections 1.3.2.1, 2.3.6, 2.3.7, 2.4.1.1]

- *[No changes to GSP text made.]* Arroyo Las Posas, Conejo Creek, and Calleguas Creek have all been identified as surface water bodies that may have a connection to the Shallow Alluvial Aquifer in the Pleasant Valley Basin. Arroyo Las Posas is ephemeral in the Pleasant Valley Basin and is likely to be a disconnected losing stream, and Conejo Creek and Calleguas Creek are perennial due to wastewater treatment discharges. Numerical modeling estimates of annual recharge to groundwater from Arroyo Las Posas, Conejo Creek, and Calleguas Creek are provided in Section 2.3.6. However, while the model results list net recharge to groundwater via stream loss, the discussion in Sections 2.3.6 and 2.3.7 indicates there is insufficient knowledge to build a conceptual model of the extent of losing and gaining reaches.

Checklist Items 11 to 20 - Identification, Mapping and Description of GDEs (23 CCR §354.16)

[Section 2.3.7 Groundwater-Dependent Ecosystems (pp. 2-25 to 2-27)]

- *[We applaud the thoughtful characterization of Wetland and Vegetative GDEs in the Pleasant Valley Basin area.]* GDEs have been identified and mapped during the GSP development process using an earlier version of the statewide database of GDE indicators (iGDE v0.3.1; TNC, 2017) and TNC's GDE Guidance document (Rohde et al., 2018). In addition to the mapping of basin GDEs, it also includes both an assessment of the hydrologic and ecological conditions of the potential GDEs. Given the uncertainty regarding the depths to groundwater within these areas, the ecosystems are appropriately considered potential GDEs, with future monitoring needs identified to assess the degree to which existing habitat is reliant on groundwater.

Checklist Items 21 and 22 - Water Budget (23 CCR §354.18)

[Section 2.4 Water Budget (p. 2-28)]

- *[We applaud the thoughtful characterization of the water budget, and inclusion of natural systems.]* The water budget includes the natural system surface hydrology components, including the surface water recharge from the Arroyo Las Posas, Conejo Creek, and Calleguas Creek and natural vegetation evapotranspiration (ET) along these riparian systems. These were modeled using the UWCD numerical model.

Checklist Items 23 to 25 - Sustainability Goal (23 CCR §354.24)

[Section 3.1 Introduction to Sustainable Management Criteria (p. 3-2)]

- *[No response required. No changes to GSP text made.]* The Fox Canyon Groundwater Management Agency (FCGMA) Board of Directors adopted planning goals in 2015 that "Promote water levels that mitigate or minimize undesirable results (including pumping trough depressions, **surface water connectivity** [emphasis added], and chronic lowering of water levels)." However, under the current and known future conditions described in Section 3.3.6, the sustainability goal does not include sustainability criteria for surface water connectivity.

Checklist Items 30 to 46 - Undesirable Results (23 CCR §354.26

[Section 3.3.6 Depletions of Interconnected Surface Water (pp. 3-12 to 3-13)]

- *[We applaud the clear recognition of GDEs as an important beneficial use that must be protected.]* The GSP clearly states: "The undesirable result associated with depletion of interconnected surface water in the PVB is loss of groundwater-dependent ecosystem (GDE) habitat." We applaud this clear recognition of GDEs as an important beneficial use that must be protected. We also agree with further statements that 1) undesirable results are not currently occurring, 2) linkage between groundwater and the potential GDEs must be established, and 3) if future projects involve the use of the Shallow Alluvial Aquifer then "depletion of interconnected surface water may be possible, and significant and unreasonable impacts may occur."

Checklist Items 27 to 29 - Minimum Thresholds (23 CCR §354.28)

[Section 3.4.6 Minimum Thresholds – Depletions of Interconnected Surface Water (p. 3-20)]

- *[Our comment has been adequately addressed through changes in the GSP text.]* We agree that no minimum thresholds need to be proposed at this time. The statement that Calleguas Creek and Conejo Creek are ephemeral streams need to be corrected as they are perennial within PBV. We would also request that the statement "depletion of interconnected surface water in the PVB is not currently occurring and is unlikely to occur in the future" be struck. Earlier text in Section 2.3.7 makes it clear that this is not known. Rather, we recommend language like that from the Oxnard Subbasin GSP: "if projects that produce groundwater from the Shallow Alluvial Aquifer are implemented, the need for specific water level minimum thresholds in it should be reevaluated".

Checklist Item 26 - Measurable Objectives (23 CCR §354.30

[Section 3.5.6 Measurable Objectives – Depletions of Interconnected Surface Water (p. 3-25)]

- *[Our comment has been adequately addressed through GSP text changes.]* We agree that no minimum thresholds need to be proposed at this time. The statement that Calleguas Creek and Conejo Creek are ephemeral streams needs to be corrected as they are perennial within PBV. We would also request that the statement "depletion of interconnected surface water in the PVB is not currently occurring and is unlikely to occur in the future" be struck. Earlier text in Section 2.3.7 makes it clear that this is not known and may be an identifiable data gap. Rather, we recommend language like that from the Oxnard Subbasin GSP: "if projects that produce groundwater from the Shallow Alluvial Aquifer are implemented, the need for specific water level minimum thresholds in it should be reevaluated".

Checklist Items 47, 48 and 49 - Monitoring Network (23 CCR §354.34)

[Section 4.3.6 Depletions of Interconnected Surface Water (p. 4-9)]

- *[No changes to GSP text made.]* We recommend including remote sensing vegetative indices as a low cost approach to monitor baseline conditions of GDEs. TNC's free online tool, GDE Pulse (Attachment E), allows GSAs a way to assess changes in GDE health using remote sensing data sets; specifically, the Normalized Difference Vegetation Index (NDVI), which is a satellite-derived index that represents the greenness of vegetation and Normalized Difference Moisture Index (NDMI), which is a satellite-derived index that represents water content in vegetation.

[Section 4.6.5 Shallow Groundwater Monitoring near Surface Water Bodies and GDEs (p.4-15)]

- *[No changes to GSP text made.]* The GSP notes the lack of shallow groundwater monitoring wells in the Shallow Alluvial Aquifer that can be used to monitor ISWs and GDEs along the Arroyo Las Posas, Conejo Creek, and Calleguas Creek. We do not think this is necessary for the Arroyo Las Posas. We recommend further investigation of the water level records in the younger alluvium that are available from shallow wells associated with groundwater remediation cases and made available on GeoTracker. If these water level records can demonstrate the groundwater connection, or lack thereof, then the data gap regarding connectivity can be closed. This could be very useful given that there is limited funding available to install new monitoring wells. ~~and this is currently a low priority given that the Shallow Alluvial Aquifer is not a principal aquifer.~~

[Section 4.6.6 Surface Water: Flows in Agricultural Drains in the PVB (p. 4-15)]

- *[No changes to GSP text made.]* We recommend surveying the water surface elevation in the drains, as they should provide easy to measure, calibration head values for the numerical model and good indication of the semi-perched aquifer elevations.

Checklist Items 50 and 51 - Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)

[Section 5 Projects and Management Actions]

- *[No response required. No changes to GSP text made.]* Section 2.3.8, Potential Recharge Areas, identifies potential future recharge areas that have the most favorable soil recharge rates. These are along the Arroyo Las Posas, Conejo Creek, and Calleguas Creek. Consistent with existing grant and funding guidelines for SGMA-related work, priority should be given to multi-benefit projects that can address water quantity as well as provide environmental benefits or benefits to disadvantaged communities. TNC recommends the GSA look for environmental partners to co-develop such multi-benefit projects that benefit supply and environment; our perspective is that additional funding can be gained from such projects.

Attachment C

Freshwater Species Located in the Pleasant Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Pleasant Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[2]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[3] as well as on The Nature Conservancy's science website[4].

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aix sponsa	Wood Duck			
Anas americana	American Wigeon			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya collaris	Ring-necked Duck			
Bucephala albeola	Bufflehead			
Butorides virescens	Green Heron			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	BCC	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Himantopus mexicanus	Black-necked Stilt			

[2] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[3] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[4] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Icteria virens	Yellow-breasted Chat		SSC	BSSC - Third priority
Ixobrychus exilis hesperis	Western Least Bittern		SSC	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oreothlypis luciae	Lucy's Warbler		SSC	BSSC - Third priority
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		SSC	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Piranga rubra	Summer Tanager		SSC	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Vireo bellii	Bell's Vireo			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
CRUSTACEANS				
Cyprididae fam.	Cyprididae fam.			
Hyalella spp.	Hyalella spp.			
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		SSC	ARSSC
Anaxyrus boreas boreas	Boreal Toad			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Anaxyrus punctatus	Red-spotted Toad			
Pseudacris cadaverina	California Treefrog			ARSSC
Rana draytonii	California Red-legged Frog	Threatened	SSC	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	SSC	ARSSC
Taricha torosa	Coast Range Newt		SSC	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		SSC	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTEBRATES				
Ablabesmyia spp.	Ablabesmyia spp.			
Anax spp.	Anax spp.			
Apedilum spp.	Apedilum spp.			
Argia spp.	Argia spp.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Callibaetis spp.	Callibaetis spp.			
Centroptilum spp.	Centroptilum spp.			
Chaetarthria spp.	Chaetarthria spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Cladopelma spp.	Cladopelma spp.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Coenagrion spp.	Coenagrion spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corisella decolor				Not on any status lists
Corixidae fam.	Corixidae fam.			
Cricotopus bicinctus				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Cryptotendipes spp.	Cryptotendipes spp.			
Culicidae fam.	Culicidae fam.			
Dicrotendipes spp.	Dicrotendipes spp.			
Enallagma spp.	Enallagma spp.			
Ephydridae fam.	Ephydridae fam.			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Hydrobius spp.	Hydrobius spp.			
Hydrophilidae fam.	Hydrophilidae fam.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ischnura spp.	Ischnura spp.			
Limnophyes spp.	Limnophyes spp.			
Micropsectra spp.	Micropsectra spp.			
Nanocladius spp.	Nanocladius spp.			
Optioservus spp.	Optioservus spp.			
Parachironomus spp.	Parachironomus spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Pentaneura spp.	Pentaneura spp.			
Petrophila spp.	Petrophila spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Progomphus borealis	Gray Sanddragon			
Pseudochironomus spp.	Pseudochironomus spp.			
Pseudosmittia spp.	Pseudosmittia spp.			
Psychodidae fam.	Psychodidae fam.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Simulium argus				Not on any status lists
Simulium spp.	Simulium spp.			
Simulium vittatum				Not on any status lists
Sperchon spp.	Sperchon spp.			
Tanytarsus spp.	Tanytarsus spp.			
Tipulidae fam.	Tipulidae fam.			
Tribelos spp.	Tribelos spp.			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
MOLLUSKS				
Ferrissia spp.	Ferrissia spp.			
Hydrobiidae fam.	Hydrobiidae fam.			
Lymnaea spp.	Lymnaea spp.			
Lymnaeidae fam.	Lymnaeidae fam.			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Physa spp.	Physa spp.			
PLANTS				
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Cotula coronopifolia	NA			
Ludwigia peploides peploides	NA			Not on any status lists
Rumex kerneri	NA			
Schoenoplectus americanus	Three-square Bulrush			
Typha domingensis	Southern Cattail			
Veronica anagallis-aquatica	NA			

Notes:
ARSSC = At-Risk Species of Special Concern
BCC = Bird of Conservation Concern
BSSC = Bird Species of Special Concern
CRPR = California Rare Plant Rank
IUCN = International Union for Conservation of Nature
SSC = Species of Special Concern

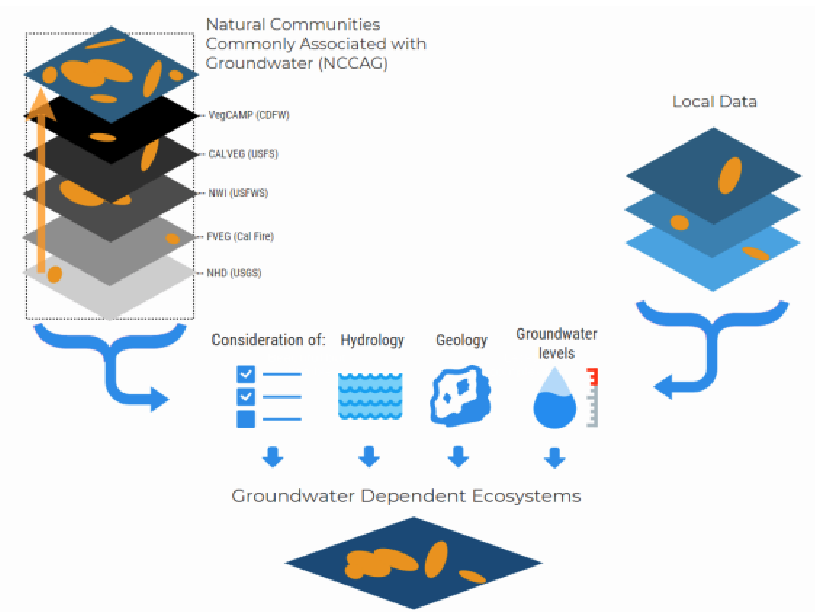
Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[5] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[6]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[5] *NC Dataset Online Viewer:* *https://gis.water.ca.gov/app/NCDatasetViewer/*

[6] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[7]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[8] on the Groundwater Resource Hub[9], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

---

[7] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[8] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[9] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

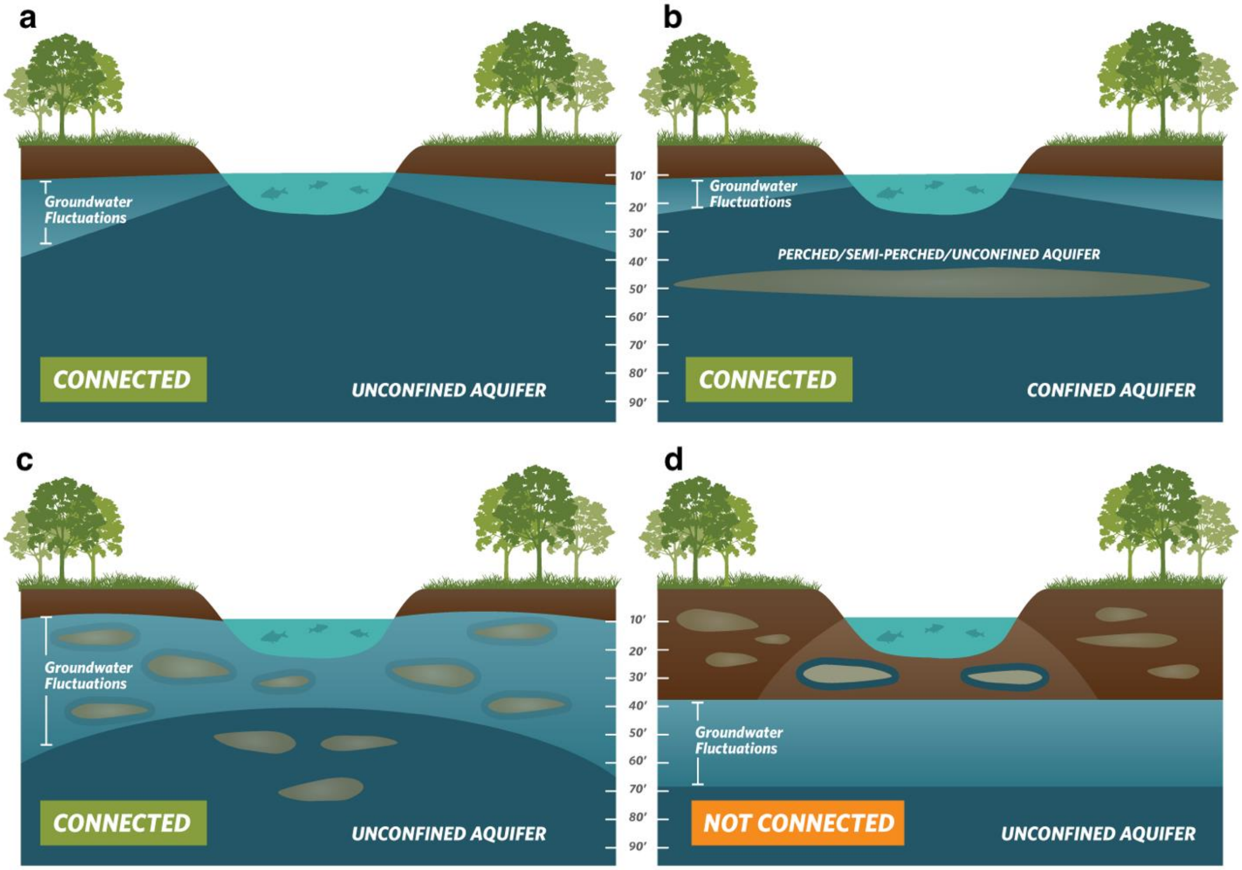


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[10] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[11] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[12] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[13]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network (see Best Practice #6).

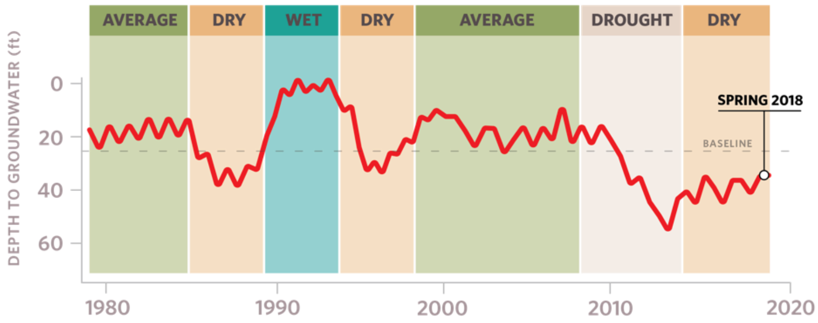


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[10] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[11] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[12] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[13] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[14], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

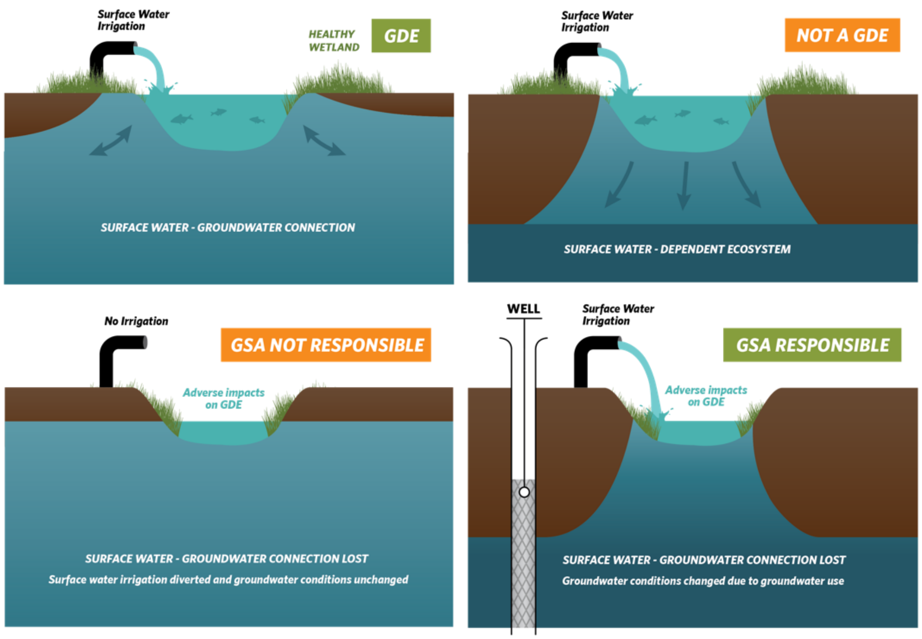


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[14] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

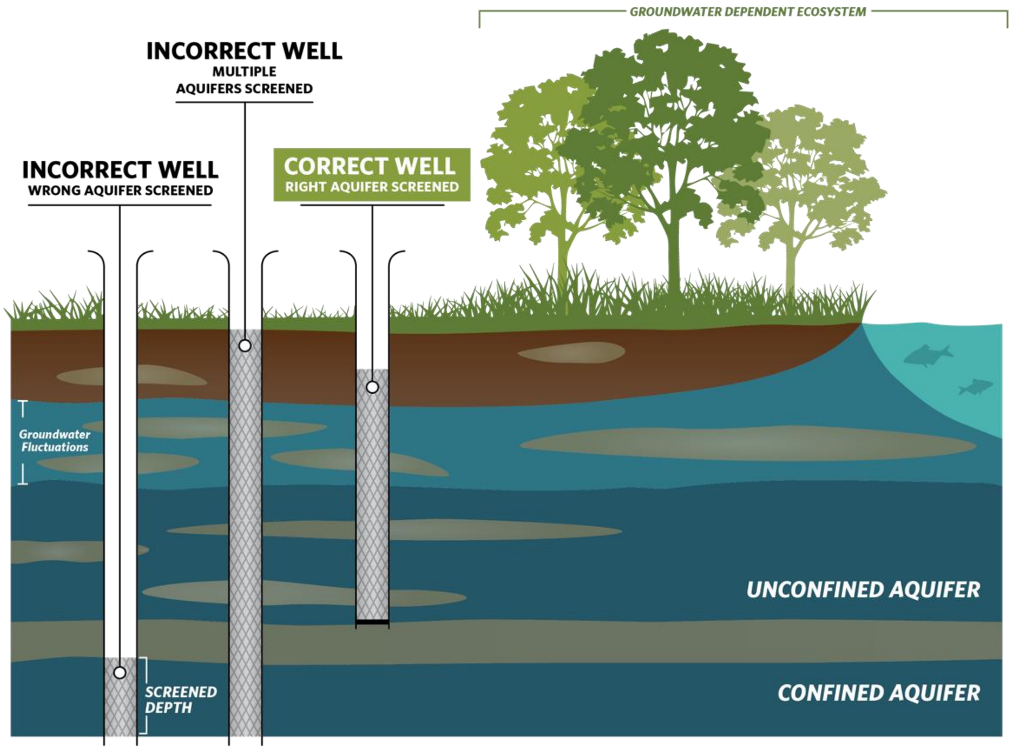


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[15] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

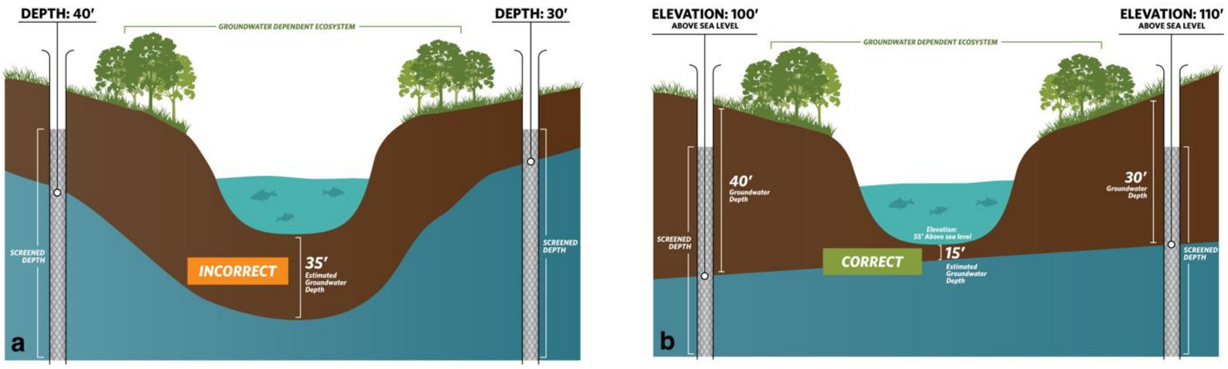


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

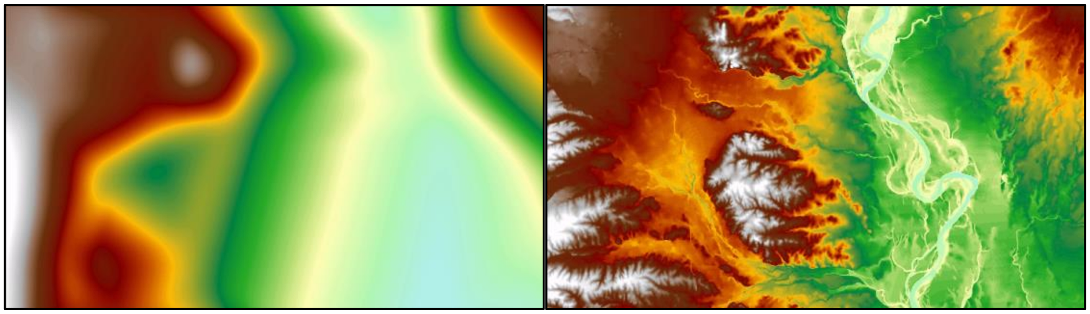


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

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[15] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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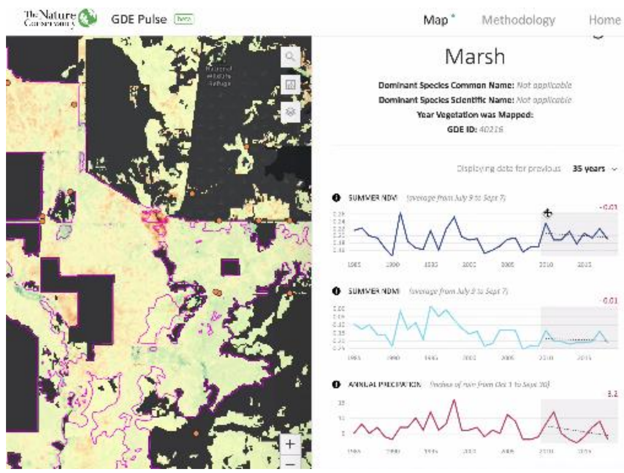
Visit
https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[16]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[17]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[16] *The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website:* *https://gis.water.ca.gov/app/NCDatasetViewer/#*

[17] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[18]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[19]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[20] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[18] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[19] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[20] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Central Kings Groundwater Sustainability Plan (GSP), Kings Subbasin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Central Kings Groundwater Sustainability Agency's (GSA's) Central Kings Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing sustainable groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be insufficient in addressing environmental beneficial uses and users.

The identification of environmental beneficial users, as well as their consideration when establishing the sustainability goal, undesirable results, minimum thresholds and measurable objectives were insufficient (23 CCR §355.4(b)(4)) and lacked best available science (23 CCR §355.4(b)(1)). In the face of existing, severe overdraft, the GSP would allow groundwater management to largely ignore potential impacts to environmental beneficial users. This could result in irreparable harm to these beneficial users, undermining the intent of SGMA to achieve sustainability.

Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address within 180 days. In these cases, we strongly recommend that the Department, at a minimum, set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update. Should the treatment of environmental beneficial users be indicative of the quality of the overall plan, then we recommend the Department deem the plan inadequate.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides a map and method summary of potential ISWs.

<u>Our Key Considerations</u>

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We are disappointed to see the feedback that we provided on the draft GSP has been ignored in the final plan, as only 1 out of 56 of our comments were adequately addressed in the Final GSP. This indicates poor engagement of environmental beneficial users, which undermines the intent of SGMA to ensure that sustainability be defined locally with the participation of all users. Based on our experience the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan" (23 CCR §355.4(b)(10)).

<u>TNC recommendation</u>: We strongly recommend that DWR require the GSA to prioritize stakeholder engagement through improvements to their stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters (ISWs) – The GSP incorrectly excluded potential and/or actual ISWs because the plan did not employ the best available science. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). ISWs were excluded based on lack of continuous saturation between surface water and groundwater. This justification of automatic removal is incorrect and inconsistent with the definition of ISWs. The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. Our analysis of groundwater levels between 2011 and 2018 indicate the Kings River from Sanger to an area downstream from Reedley is likely ISW. Therefore, potential ISWs are not being managed in the GSP.

<u>Map and Assessment of potential ISWs</u>:
By combining multiple years and seasons of groundwater depth data, The Nature Conservancy has determined that within the Central Kings GSP, 8.2 river miles are gaining, 5.9 are losing, and the rest are uncertain or likely disconnected. Attachment F contains a one-page method summary and a GSP-specific map of ISWs. The interconnected surface water displayed on the map is based on the minimum groundwater depth estimated by the California Department of Water Resources between 2011 and 2018.

Note: In most cases, the groundwater depth data used to generate the ISW map does not include perched aquifers. As such, some streams marked as disconnected could in actuality, be connected.

TNC recommendation: Until a disconnection can be proven, TNC recommends that the GSP include all potential and confirmed ISWs. We recommend that the GSA conduct a thorough analysis of existing data on surface water-groundwater interconnectivity and estimate the quantity and timing of streamflow depletions in the subbasin. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 991 acres of potential GDEs occur in the GSA boundary. TNC developed the *Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs*[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

The plan does not to adequately identify, map and consider GDEs. We believe that this does not meet plan evaluation criteria (1), (4) and (10), as defined in the 23 CCR §355.4(b). In addition, the Plan does not satisfy the requirement to identify GDEs (23 CCR §Section 354.16(g)) and consider beneficial users throughout the plan. Our review found that NC Dataset polygons were improperly removed from the GDE map based on groundwater levels that were greater than 30-ft at a single point in time. This is a technically incorrect approach since groundwater levels fluctuate over seasonal and interannual time scales due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Justifying the removal of NC dataset polygons solely based on this criterion does not acknowledge that groundwater levels temporally vary and the fact that many plant species within GDEs can access groundwater depths beyond 30-feet or have adapted water stress strategies to deal with intermittent periods of deep groundwater levels. Using this methodology disregards groundwater fluctuations and can leave many GDEs unprotected in the GSP.

TNC recommendation: TNC recommends that the GSA utilize groundwater levels that represent interannual and inter-seasonal variability along with additional information provided in Attachment D which provides best practices for using the NC dataset to identify and consider GDEs throughout the GSP. Specifically, the GSA should use a Digital Elevation Model (DEM) when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment D.

Water Budget – We were disappointed to see that the water budget did not include the current, historical and projected demands of native vegetation and managed wetlands, as required under SGMA (23 CCR §354.18(a) and (b)(3)). The GSP only focused on a subset of water use sectors, including urban and agricultural users of groundwater. This is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget nor will they likely be considered in project and management actions.

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[1] *Available at:* https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

TNC recommendation: As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. As a result, the monitoring network does not adequately characterize GDEs and other environmental beneficial users of surface water and groundwater. Potential GDEs are located along surface water bodies where no further shallow groundwater monitoring is proposed, leaving recognized data gaps unfilled. Potential ISWs have been dismissed in the GSP, without proposed recommendations to improve ISW identification, mapping, and estimates of depletions. Therefore, GDEs and ISWs are not being specifically addressed by the monitoring network in the GSP.

TNC recommendation: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess potential for impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but sustainable groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at:
https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Central Kings Area Groundwater Sustainability Plan
Comments based on Draft and Final GSPs

The Central Kings Groundwater Sustainability Plan (CKGSP) adopted December 11, 2019 was reviewed by TNC. **The Public draft GSP comments and responses, provided as Appendix 2A of the GSP, were actually the North Kings GSA Comments and Responses. This error made it more difficult to assess whether our comments were addressed in the final GSP**. We compared the Public Draft GSP to the Final GSP to determine if TNC's comments on the Draft GSP were addressed in the Final GSP. This attachment lists our original comments on the complete public draft GSP as submitted to the GSA during the public comment period, and states whether or not they were addressed in the final GSP [as green text within brackets]. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

[Section 2.5.1 Description of Beneficial Uses and Users (p. 2-31)]

- *[Our comment was not addressed.]* The discussion of beneficial uses and users of groundwater focused on agricultural users, domestic well users, and City of Selma users, but environmental groups were not listed. **Please discuss how environmental groups were engaged during the GSP development process.**
- *[Our comment was not addressed.]* **Please identify whether or not the following beneficial uses and users of groundwater in the Subbasin are present: Protected Lands, including refuges, conservation areas, and recreational areas; and Public Trust Uses, including wildlife, aquatic habitat, fisheries, and recreation.**
- *[Our comment was not addressed.]* The types and locations of environmental uses, species and habitats supported, instream flow requirements, and other designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the Subbasin should be specified. **To identify environmental users, please refer to the following:**
    - The NC Dataset (https://gis.water.ca.gov/app/NCDatasetViewer/) which identifies the potential presence of groundwater dependent ecosystems in this basin.
    - The list of freshwater species located in the Kings Subbasin in Attachment C of this letter. Please take particular note of the species with protected status.
    - CDFW's California Natural Diversity Database (CNDDB) - https://www.wildlife.ca.gov/Data/CNDDB
    - USFWS's IPAC report for the Central Kings GSA (CKGSA) area - https://ecos.fws.gov/ipac/

Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8).

[Section 2.2.1 Monitoring and Management Programs (p. 2-10 to 2-15)]

- *[Our comment was not addressed.]* [Groundwater Level Monitoring (p. 2-10)] Consolidated Irrigation District (CID) has maintained a network of about 80 wells since 2001. The groundwater levels in these wells are currently measured two times per year. The Kings River Conservation District (KRCD) began studying groundwater level trends in 1987 and prepared annual groundwater reports between 2003 and 2014 that included regional groundwater contour maps. **Please describe how existing groundwater monitoring programs are protective of GDEs or propose additional monitoring that specifically targets GDEs.**
- *[Our comment was not addressed.]* [Groundwater Extraction Monitoring (p. 2-15)] The CID does not own or operate any municipal wells. Most private wells are not metered, so the volume extracted is not known. This omission means that the groundwater used must be estimated using factors such as water use per capita and crop water demand per acre, which contributes to the uncertainty of the water budget. **Please describe how this data gap will be filled in the future.**
- *[Our comment was not addressed.]* [Surface Water Monitoring (p. 2-15)] This section states that the Kings River is monitored by "numerous agencies" (p. 2-15) but lists only the Kings River Water Association. The Kings River Fisheries Management Program is described in Section 2.2.2 Impacts to Operational Flexibility. The Kings River program includes maintenance of a 10 percent minimum capacity in the Pine Flats Reservoir for improved temperature control and year-round fish releases below the reservoir. There is no mention of ISWs or GDEs or how they are monitored. **Please explain the relationship of existing stream flow monitoring to the protection of ISWs and GDEs, and if there are instream flow criteria for the ISWs.**

[Section 2.3 Relation to General Plans (p. 2-19 to 2-25)]

- *[Our comment was not addressed.]* The Fresno, Kings and Tulare County General Plan were adopted prior to the development of the CKGSA. This section should be modified to include a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals. **Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs.**
- *[Our comment was not addressed.]* This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin and if they are associated with critical, GDE or ISW habitats. **Please identify all relevant HCPs and NCCPs within the Subbasin, and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.**
- *[Our comment was not addressed.]* Please refer to the Critical Species Lookbook[2] to review and discuss the potential groundwater reliance of critical species in the basin.

[2] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.

[Section 2.3.4 Permitting of New Wells (p. 2-24)]

- *[Our comment was not addressed.]* Well permitting is handled currently by County Health Departments. The GSP states that CID will work with counties to review new well applications. **Please include a discussion of how future well permitting will be coordinated with the GSP to assure achievement of the Plan's sustainability goals.**
- *[Our comment was not addressed.]* The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF vs. SWRCB and Siskiyou County, No. C083239). **Compliance of well permitting programs with this requirement should be stated in the GSP.**

[Section 2.4.4 Well Abandonment/Well Destruction Program (p. 2-28)]

- *[Our comment was not addressed.]* The county of Fresno has the authority to require permits for well abandonment/well destruction, but due to staffing and funding limitations the GSP notes that enforcement of this requirement is limited. **Please describe what actions will be taken by CKGSA to make sure that wells are properly abandoned.**

<u>Checklist Items 5, 6, and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)</u>

[Section 3 Basin Setting (p. 3-1 to 3-42)]

- *[This comment was addressed. Thank for you fixing the formatting of these figures.]* The following figures in Section 3 do not show up correctly in the GSP and cause the pdf application to crash: Figures 3-9, 3-19, 3-24, and 3-25. **Please correct these figures in subsequent versions of the GSP.**

[Section 3.1.7 Cross-Sections (p. 3-14)]

- *[Our comment was not addressed.]* The basin-wide cross sections provided in Figures 3-11 through 3-16 (pp. 3-18 to 3-23) are regional, and do not include a graphical representation of the manner in which shallow groundwater may interact with ISWs or GDEs that would allow the reader to understand this topic. The cross-sections have been taken from a 1969 source and, as reproduced in the GSP, are very difficult to read and understand. **Please reproduce the regional cross-sections so that they can be understood by the reader and update them to illustrate data obtained from more recent well installations. Include an example near-surface cross sections that depicts the conceptual understanding of shallow groundwater and river interactions at different locations, as well as any potential GDEs and ISWs**.

[Section 3.1.8.2 Aquifer Characteristics and Properties (p. 3-28)]

- *[Our comment was not addressed.]* In the Central Kings Subbasin, the base of the usable aquifer corresponds with the base of freshwater, generally defined as groundwater with total dissolved solids (TDS) of 2,000 milligrams per liter (mg/l), consistent with other GSAs in the Kings subbasin. In the far eastern part of the Central Kings subbasin, the base of the aquifer is defined by the top of the basement complex. As noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** Properly defining the bottom of the basin will prevent the possibility of extractors with wells deeper than the basin boundary from claiming exemption from SGMA due to their well residing outside the vertical extent of the basin boundary.

[Section 3.1.12 Recharge and Discharge Areas (p. 3-38 to 3-42]

- *[Our comment was not addressed.]* The GSP states that there are natural recharge areas, stormwater basins and constructed recharge basins. **Please include a description of these areas and note whether any features are present that attract wildlife. Please indicate whether the recharge basins are or could be operated as multiple-benefit projects that provide habitat suitable for migrating birds or other species, and could be included in an HCP or NCCP.**
- *[Our comment was not addressed.]* Wetlands were mapped along the Kings River, as identified from US Forest Service's National Wetland Inventory, according to the GSP. **Please discuss in the GSP that these wetlands are considered potential GDEs and refer to Figure 3-63. Also, if the Wetland Inventory was in fact the US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI), then correct the text and reevaluate the data. The NWI does not always include or segregate separate existing wetlands that are on the periphery of other features. Please describe the wetland types in more detail. If they are truly vernal pools confined by a clay layer then they are not GDEs, but they must meet the criteria of a vernal pool as described by the California Rapid Assessment Methodology or the United States Army Corps of Engineers to qualify.**

<u>Checklist Items 8, 9, and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)</u>

[Section 3.2.7 Surface Water and Groundwater Interconnection (pp. 3-89 to 3-91)]

- *[Our comment was not addressed.]* ISWs are best estimated by first determining which reaches are completely disconnected from groundwater. This approach would involve comparing groundwater elevations with a land surface Digital Elevation Model (DEM) that could identify which surface waters have groundwater consistently below surface water features, such that an unsaturated zone would separate surface water from groundwater. **Please provide or refer to depth to groundwater contour maps in this section. See Attachment D for best practices for completing**

this step. Specifically, ensure that the first step is contouring groundwater elevations, and the subtracting this layer from land surface elevations from a DEM to estimate depth to groundwater contours across the landscape. This will provide much more accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. Contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make.

- *[Our comment was not addressed.]* In the Kings River between Highway 180 and Sanger, shallow wells were installed at proposed gravel processing facilities and wastewater facilities by KDSA (KDSA 2017). The GSP states that the "KDSA further indicates that along the reach of the Kings River upstream of the Reedley narrows, the groundwater is indicated to be in direct hydraulic communication with streamflow in the Kings River" (p. 3-91). The groundwater in this area is shallow based on DWR measurements. This finding needs to be illustrated using cross-sections with measured channel bed elevations and depths to groundwater. **Please provide a cross-section at this location to show the relationship between the depth to groundwater and the bed of the river channel. If channel bed elevations are not known, please identify as a data gap and further discuss in the Monitoring section of the GSP.**

<u>Checklist Items 11 to 15, Identifying and Mapping GDEs (23 CCR §354.16)</u>

[Section 3.2.8 Groundwater Dependent Ecosystems (p. 3-91)]

- *[Our comment was not addressed.]* The NC dataset is a starting point for GSAs to identify GDEs in their basin/subbasin. The NC dataset has 991 acres of potential GDEs mapped within the CKGSA area, representing a significant amount of GDEs to be considered. Note that this is a starting point, thus not all potential GDEs are mapped and not all ecosystems mapped are GDEs. **Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled by the monitoring network**. Specifically, please note:
  - *[Our comment was not addressed.]* The text refers to Spring of 2017 depth to groundwater contours, however these contours are not shown. Figure 3-53 shows depth to groundwater contours for Spring 2015, however this figure is not referred to in this section. **Please note the following best practices for developing depth to groundwater contours**:
    - Only wells monitoring the upper unconfined aquifer are being used to verify whether polygons in the NC dataset are supported by groundwater;
    - The wells used for interpolating depth to groundwater sufficiently close (<5km) to NC Dataset polygons reflect local conditions relevant to ecosystems;

        - The wells used for interpolating depth to groundwater are screened within the surficial unconfined aquifer and capable of measuring the true water table; and
        - Depth to groundwater is contoured using groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a DEM to estimate depth to groundwater contours across the landscape. This will provide much more accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from measurements at wells assume that the land surface is constant, which is a poor assumption to make. It is better to assume that water surface elevations are constant in between wells, and then calculate depth to groundwater using a DEM of the land surface to create the contour map.
    - *[Our comment was not addressed.]* It is highly advised that seasonal and interannual groundwater fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one point in time (e.g., Spring 2017) can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. **We highly recommend using depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. Ensure that groundwater condition data prior to the SGMA benchmark date of January 1, 2015 is included in the analysis. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network**.
    - *[Our comment was not addressed.]* **Please provide rationale for the 30-foot criteria cited in the text.** The text states (p. 3-91): "Recognizing that much of the Kings Subbasin has a depth to groundwater greater than the deepest vegetative GDE rooting depth of thirty feet, many of the GDEs identified in the NC Dataset Viewer were mischaracterized." In TNC's GDE Guidance, the depth criteria of 30 feet is presented as a criterion for *inclusion*, not a standalone criterion for *exclusion*. In other words, if groundwater is within 30 feet of the ground surface, then a GDE can be identified. If it is not, then further analysis must be conducted (see Appendix III of the GDE Guidance, Worksheet 1, for other indicators of GDEs). **Please indicate what vegetation is present in the possible GDEs.** The actual rooting depth of vegetation growing in the area should be considered, and this will vary by species dominance and habitats present. For example, some phreatophytes can root to 120-feet deep in more arid and drought stressed environments. Furthermore, rooting depths are likely to spatially vary based on the local

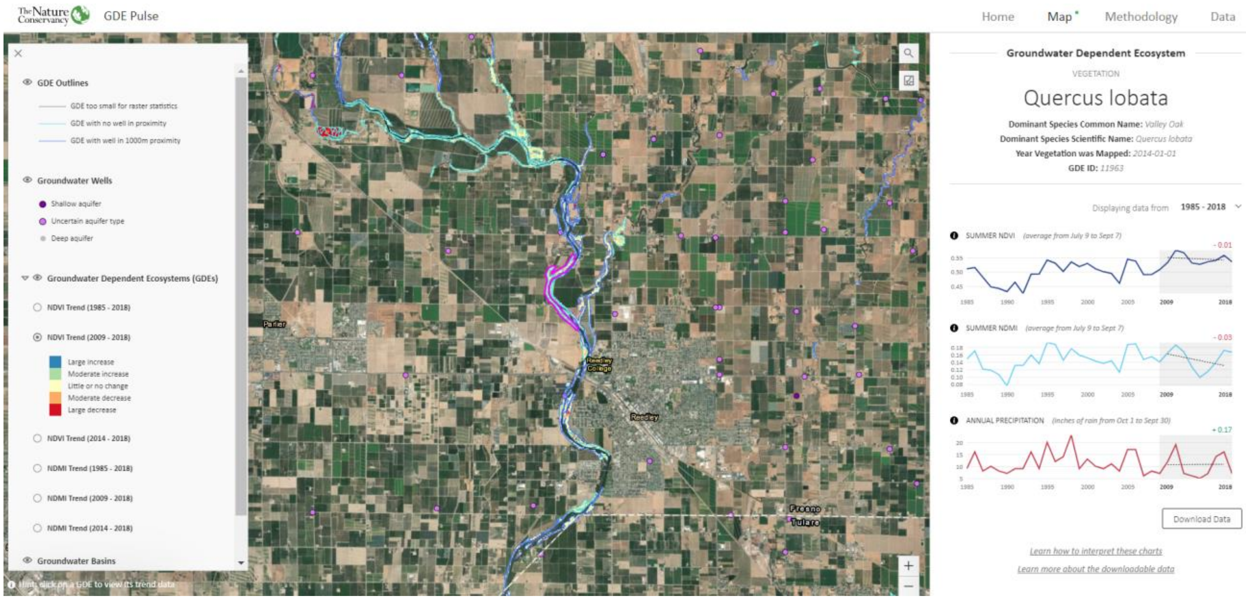
hydrologic conditions available to the plant. Maximum rooting depths do not take capillary action into consideration, which will vary with soil type and is an important consideration since woody phreatophytes generally do not prefer to have their roots submerged in groundwater for extended periods of time, and hence can access groundwater at deeper depths.

  - *[Our comment was not addressed.]* The text states: "The Kings Subbasin also categorized GDEs within 100 feet of the Kings River and the San Joaquin River as "Possible GDEs." **Please clarify how the 100-foot buffer was used to include or exclude GDEs in the CKGSA area, and how this is supported by groundwater level and plant physiological data. If there is a potential GDE near the river, we suggest the entire GDE is included, rather than using an arbitrary 100-foot cutoff.**
  - *[Our comment was not addressed.]* The text states (p. 3-91): "Spring 2017 depth to groundwater contours and NC Dataset viewer GDEs were overlaid to identify GDEs in areas with depth to groundwater greater than 30 feet. GDEs meeting this criterion were categorized as 'Rejected GDEs' and depicted in purple in Figure 3-62 and 3-63." However, Figure 3-62 shows rejected GDEs in *light green and pink*. Figure 3-63 shows *wetlands* in purple (not rejected GDEs). **Please correct the callouts and description of these figures. The basin's GDE shapefile, which is submitted via the SGMA Portal, should include two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed). In addition, in the text please cite the acreage of GDEs retained and removed.**

Checklist Items 16 to 20, Describing GDEs (23 CCR §354.16)

[Section 3.2.8 Groundwater Dependent Ecosystems (p. 3-91)]

- *[Our comment was not addressed.]* **Please provide information on the historical or current groundwater conditions in the GDEs or the ecological conditions present**. Refer to GDE Pulse (https://gde.codefornature.org; See Attachment E of this letter for more details) or any other locally available data to describe depth to groundwater trends in and around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in the CKGSA area:



- *[Our comment was not addressed.]* **Please provide an ecological inventory (see Appendix III, Worksheet 2 of the GDE Guidance) for all potential GDEs that includes the vegetation types or habitat types and rank the GDEs as having a high, moderate or low value; and what characterizes the rank.**
- *[Our comment was not addressed.]* **Please identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat, were found in or near any of the GDEs, since some organisms rely on uplands and wetlands during different stages of their lifecycle**. Resources for this include the list of freshwater species located in the Kings Subbasin that can be found in Attachment C of this letter, the Critical Species Lookbook, and CDFW's CNDDB database.
- *[Our comment was not addressed.]* **For each identifiable GDE unit with supporting hydrological datasets please include the following:**
    - Plot and provide hydrological datasets for each GDE.
    - Define the baseline period in the hydrologic data.
    - Classify GDE units as having high, moderate, or low susceptibility to changes in groundwater.
    - Explore cause-and-effect relationships between groundwater changes and GDEs.
- *[Our comment was not addressed.]* **For each identifiable GDE unit without supporting hydrological datasets please describe data gaps and/or insufficiencies.**
- *[Our comment was not addressed.]* **Compile and synthesize biological data for each GDE unit by including:**
    - Plots of biological datasets for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.
    - Describe data gaps/insufficiencies.

- *[Our comment was not addressed.]* **Description of potential effects on GDEs, land uses, and property interests, including:**
  - Cause-and-effect relationships between GDE and groundwater conditions.
  - Impacts to GDEs that are considered to be "significant and unreasonable".
  - Report known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities.
  - Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).
  - Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.

<u>Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)</u>

[Section 3.3.9 Historical Water Budget (p. 3-110)]

- *[Our comment was not addressed.]* **Please clarify whether a term is included for native or riparian vegetation evapotranspiration and for wetlands in the CKGSA area historical, current, and future water budgets.**

[Section 3.3.11 Projected Water Budget (p. 3-117)]

- *[Our comment was not addressed.]* Given the uncertainty associated with Kings River water supply into the future, the assumption was made that the historical water delivery from the Kings River would be maintained. This assumption is highly uncertain and is not conservative. The diversion of Kings River flows may require additional provision for storage in the non-irrigation or low-irrigation season. **Please add discussion of the potential impacts to the flow in the Kings River and to groundwater conditions on GDEs, aquatic ecosystems and instream flow requirements due to climate change.**

<u>Checklist Items 23 to 25 – Sustainability Goal (23 CCR §354.24)</u>

[Section 4.1 Sustainability Goal (p. 4-4)] The Sustainability Goal does not consider GDEs or ISWs.

- *[Our comment was not addressed.]* **Since GDEs are likely present in the CKGSA area (see comments under Checklist Items 16-20) they should be recognized as beneficial users of groundwater and should be included in the Sustainability Goal. In addition, a statement about any intention to address pre-SGMA impacts should be included.**
- *[Our comment was not addressed.]* The Plan states that there are ISWs along the Kings River. Information that supports the potential ISWs along this river include Figure 3-62 that identifies potential GDEs, and the depth to water data for Spring 1997 and Spring 2012 presented at the end of Section 3 (Appendix 3C, Technical Memorandum 4). **Please identify and describe all ISWs and include them in the GSP.**

- *[Our comment was not addressed.]* GDEs are dependent, in part, on suitable water quality; however, the Plan only considers water quality for irrigation and domestic use. **TNC recommends including ISWs and their potential GDEs in the sustainability goal and criteria. Since GDEs may be affected by water quality, they should be included in the Sustainability Goal.**

Checklist Item 26 – Measurable Objectives (23 CCR §354.30)

[Sections 4.2.3 Measurable Objectives for Groundwater Levels (p. 4-46)]

- *[Our comment was not addressed.]* This Measurable Objective does not consider GDEs. GDEs are often adjacent to streams or associated with riparian corridors where ISWs exist, even if only seasonally or discontinuously along a longitudinal or lateral profile. **Please include GDEs (see comments under Checklist Items 8-10) in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Sections 4.5.4 Measurable Objectives for Water Quality (p. 4-63)]

- *[Our comment was not addressed.]* This Measurable Objective does not consider water quality needs of GDEs. **Please include a discussion about GDEs and water quality and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Sections 4.7.2 Measurable Objectives for Interconnected Surface Water (p. 4-71)]

- *[Our comment was not addressed.]* The text states (p. 4-71): "Undesirable results to surface water related to groundwater pumping the Kings Basin are not likely to occur and criteria, including measurable objectives has therefore not been set for the Kings Basin under regulation §354.26(d)." Because ISWs do occur in the CKGSA area (p. 3-91), then Sustainable Management Criteria including Measurable Objectives should be established. The GSP has not shown evidence that undesirable results related to this sustainability indicator are not likely to occur. **Please further discuss ISWs in this section and set measurable objectives and interim milestones to help achieve the sustainability goal as it pertains to the environment.**

Checklist Item 27-29 – Minimum Thresholds (23 CCR §354.28)

[Sections 4.2.2 Minimum Thresholds for Groundwater Levels (p. 4-26)]

- *[Our comment was not addressed.]* This Minimum Threshold does not consider GDEs. **Please include GDEs in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Sections 4.5.3 Minimum Thresholds for Groundwater Quality (p. 4-61)]

- *[Our comment was not addressed.]* This Minimum Threshold does not consider water quality needs of GDEs. **Please include a discussion about GDEs and water quality and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

Checklist Item 30-46 – Undesirable Results (23 CCR §354.26)

[Section 4.2.1 Undesirable Results for Groundwater Levels (p. 4-5)]

- *[Our comment was not addressed.]* This section only describes undesirable results relating to human beneficial uses of groundwater and neglects environmental beneficial uses and users that could be adversely affected by chronic groundwater level decline. **Please add potential adverse impacts to GDEs and native freshwater species to the discussion of potential undesirable results presented in this section.**
- *[Our comment was not addressed.]* The GDE Pulse web application developed by TNC provides easy access to 35 years of satellite data to view trends of vegetation metrics, groundwater depth (where available), and precipitation data. This satellite imagery can be used to observe trends for NC dataset polygons within and near the GSA. Over the past 10 years (2009-2018), some NC dataset vegetation polygons have experienced adverse impacts to vegetation growth and moisture along the Kings River. An example screen shot from the GDE Pulse tool is presented under Checklist Items 11-15 above.

[Section 4.5.2 Undesirable Results for Groundwater Quality (p. 4-59)]

- *[Our comment was not addressed.]* This section describes undesirable results in terms of meeting drinking water standards. The following is a link to a paper by Smith, Knight and Fendorf (2018) titled "Overpumping leads to California groundwater arsenic threat": (https://www.nature.com/articles/s41467-018-04475-3). **The section should be modified to state that overpumping and dewatering of aquitards has been identified as a potential source of elevated arsenic concentrations above drinking water standards in San Joaquin Valley aquifers. In addition, any potential undesirable results from degradation of water quality that may impact GDEs and freshwater species in the area should be discussed in this section.**

[Section 4.7.1 Undesirable Results for Interconnected Surface Water (p. 4-71)]

- *[Our comment was not addressed.]* The text states (p. 4-71): "Due to existing river management programs and/or the lack of continuous interconnected surface water within the Kings Basin, undesirable results to surface water related to groundwater pumping are not likely to occur." GDEs are often adjacent to streams or associated with riparian corridors where ISWs exist, even if only seasonally or are discontinuous along a longitudinal profile. ISWs that are not continuously connected spatially and/or temporally are still ISWs and should not be excluded from this GSP. **Even when ISWs are not continuously connected, they should be included in the Measurable Objectives. Please include GDEs and ISWs in this section and**

whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.

- *[Our comment was not addressed.]* The analysis for potential depletion of ISWs in Section 4.7 should include all beneficial uses and users of surface water that could be affected by groundwater withdrawals, including environmental users. **Please state in this section whether there are any instream flow requirements and critical habitat designations and set measurable objectives and interim milestones to help achieve the sustainability goal as it pertains to the environment.**

Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)

[Section 5.2 Groundwater Level Monitoring (pp. 5-3 to 5-12)]

- *[Our comment was not addressed.]* **Please address how the need to link and correlate groundwater level declines to biological responses and significant and adverse impacts to GDEs and ISWs will be addressed by the monitoring network.**
- *[Our comment was not addressed.]* The proposed wells to be used for monitoring groundwater levels are shown in Figure 5-1 (p. 5-6). The figure shows which monitoring wells have well construction information. The text mentions areas to be monitored include the unconfined aquifer and the confined aquifer below the Corcoran Clay in the western part of the CKGSA area. No distinction is shown on Figure 5-1 for wells screened in the unconfined or confined aquifer. **Please distinguish on this figure which wells will be used to monitor the unconfined and confined aquifers. To accurately characterize GDEs, please clarify how the unconfined aquifer will be monitored and how many wells will be used.**

[Section 5.7 Depletion of Interconnected Surface Water Monitoring (pp. 5-30 to 5-35)]

- *[Our comment was not addressed.]* Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater *and related surface conditions* (emphasis added). Groundwater level monitoring alone may be insufficient to establish a linkage between groundwater extraction and potentially resulting impacts to environmental resources associated with GDEs and ISWs. The cause-effect relationship between groundwater levels and the biological responses that could result in significant and unreasonable impacts to ISWs and GDEs depends on a number of complicated factors, and this relationship is not characterized or discussed. As such, it is not possible to determine whether the proposed monitoring is sufficiently protective to ensure significant and unreasonable impacts to GDEs and ISWs will be prevented. **To clarify if GDEs are present, consider adding monitoring of potential GDEs at any locations where ISWs are present regardless of their seasonal or discontinuous nature.**
- *[Our comment was not addressed.]* The text states (p. 5-35): "The river invert adjacent to Wells 31 and 41 will be surveyed to determine the invert and compare to the levels depicted in the hydrographs." This is the only data gap identified with respect to ISWs. **Please further reconcile data gaps in monitoring for ISWs**

with specific recommendations (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features to improve ISW mapping and inform an adequate analysis.

Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)

[Section 6.1 Introduction (pp. 6-3 to 6-5)]

- *[Our comment was not addressed.]* The CKGSA area includes GDEs and ISWs (see our comments under Checklist Items 8-10 and 16-20 above) that are beneficial uses and users of groundwater and may include potentially sensitive resources and protected lands. Environmental resource protection needs should be considered in establishing project priorities. In addition, consistent with existing grant and funding guidelines for SGMA-related work, priority should be given to multi-benefit projects that can address water quantity as well as providing environmental benefits or benefits to disadvantaged communities. **Please include environmental benefits and multiple benefits as criteria for assessing project priorities.**

[Section 6.2 Projects (pp. 6-6 to 6-11)]

- *[Our comment was not addressed.]* This section identifies multiple recharge projects; however, the descriptions of Measurable Objectives for these projects only identifies benefits to water level and storage. Because maintenance or recovery of groundwater levels, or construction of recharge facilities, may have potential environmental benefits in many cases it would be advantageous to demonstrate multiple benefits from a funding and prioritization perspective.
    - **For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.**
    - If ISWs will not be adequately protected by those listed, **please include and describe additional management actions and projects targeted for protecting ISWs.**
    - Recharge ponds, reservoirs and facilities for managed stormwater recharge projects can be designed as multi-benefit projects that include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such facilities have been incorporated into local Habitat Conservation Plans (HCPs) and Natural Community Conservation Plans (NCCPs), more fully recognizing the value of the habitat that they provide and the species they support. **For projects that construct recharge ponds, consider identifying if there is habitat value incorporated into the design and how the recharge ponds will be managed to benefit environmental users. Grant and funding opportunities for SGMA-related work may apply to multi-benefit projects that can address water quantity as well as provide environmental benefits. Please include environmental benefits and multiple benefits as criteria for assessing project priorities.**

- For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

[Section 6.3 Management Actions (p. 6-11)]

- *[Our comment was not addressed.]* This section states that CKGSA does not plan to use Management Actions to meet sustainability goals (p. 6-11). **Please consider adding Management Actions which include education and outreach for protection of GDEs and ISWs as well as specific management of these ecosystems and the species they provide for.**

Attachment C

Freshwater Species Located in the Kings Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Kings Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[3]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[4] as well as on TNC's science website[5].

Scientific Name	**Common Name**	**Legally Protected Species**		
		Federal	**State**	**Other**
Birds				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	BCC	SCC	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		SCC	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		SCC	

[3] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[4] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[5] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		SCC	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cypseloides niger	Black Swift	BCC	SCC	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	BCC	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	BCC	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		SSC	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			

Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		SSC	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		SSC	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		SSC	BSSC - Third priority
Crustaceans				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	SSC	IUCN - Vulnerable
Branchinecta mesovallensis	Midvalley Fairy Shrimp		SSC	
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	SSC	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		SSC	IUCN - Near Threatened
Fishes				
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Cottus asper ssp. 1	Prickly sculpin			Least Concern - Moyle 2013
Cottus gulosus	Riffle sculpin		SSC	Near-Threatened - Moyle 2013
Gasterosteus aculeatus microcephalus	Inland threespine stickleback		SSC	Least Concern - Moyle 2013

Lampetra hubbsi	Kern brook lamprey		SSC	Vulnerable - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		SSC	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		SSC	Near-Threatened - Moyle 2013
Mylopharodon conocephalus	Hardhead		SSC	Near-Threatened - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus tshawytscha - CV fall	Central Valley fall Chinook salmon	SSC	SSC	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV late fall	Central Valley late fall Chinook salmon	SSC		Endangered - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
Herps				
Actinemys marmorata marmorata	Western Pond Turtle		SSC	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus boreas halophilus	California Toad			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	SSC	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	SSC	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	SSC	ARSSC
Taricha torosa	Coast Range Newt		SSC	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis fitchi	Valley Gartersnake			Not on any status lists
Thamnophis sirtalis sirtalis	Common Gartersnake			
Insects and Other Invertebrates				
Acentrella insignificans	A Mayfly			

Acentrella spp.	Acentrella spp.			
Anax junius	Common Green Darner			
Argia agrioides	California Dancer			
Argia emma	Emma's Dancer			
Argia nahuana	Aztec Dancer			
Argia spp.	Argia spp.			
Baetidae fam.	Baetidae fam.			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Brillia spp.	Brillia spp.			
Chironomidae fam.	Chironomidae fam.			
Cordulegaster dorsalis	Pacific Spiketail			
Cricotopus spp.	Cricotopus spp.			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Enallagma cyathigerum				Not on any status lists
Epeorus spp.	Epeorus spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Erpetogomphus compositus	White-belted Ringtail			
Erythemis collocata	Western Pondhawk			
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon spp.	Fallceon spp.			
Glossosoma spp.	Glossosoma spp.			
Glossosomatidae fam.	Glossosomatidae fam.			
Heptageniidae fam.	Heptageniidae fam.			
Hetaerina americana	American Rubyspot			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Ischnura perparva	Western Forktail			
Lepidostoma baxea	A Caddisfly			
Lepidostoma spp.	Lepidostoma spp.			
Lestes congener	Spotted Spreadwing			

Libellula croceipennis	Neon Skimmer			
Libellula saturata	Flame Skimmer			
Limnophyes spp.	Limnophyes spp.			
Ochrotrichia burdicki	A Caddisfly			
Pachydiplax longipennis	Blue Dasher			
Pantala flavescens	Wandering Glider			
Pantala hymenaea	Spot-winged Glider			
Plathemis lydia	Common Whitetail			
Polypedilum spp.	Polypedilum spp.			
Protoptila spp.	Protoptila spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Serratella micheneri	A Mayfly			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Stylurus olivaceus	Olive Clubtail			
Telebasis salva	Desert Firetail			
Tramea lacerata	Black Saddlebags			
Tricorythodes spp.	Tricorythodes spp.			
Zoniagrion exclamationis	Exclamation Damsel			
Mammals				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
Mollusks				
Anodonta californiensis	California Floater		SSC	
Ferrissia spp.	Ferrissia spp.			
Gyraulus spp.	Gyraulus spp.			
Margaritifera falcata	Western Pearlshell		SSC	
Menetus spp.	Menetus spp.			
Physa spp.	Physa spp.			
Physella virgata	Protean Physa			CS
Pisidium spp.	Pisidium spp.			
Planorbella tenuis	Mexican Rams-horn			CS
Planorbella trivolvis	Marsh Rams-horn			CS

Pyrgulopsis stearnsiana	Yaqui Springsnail			T
Sphaeriidae fam.	Sphaeriidae fam.			
Plants				
Alnus rhombifolia	White Alder			
Alopecurus carolinianus	Tufted Foxtail			
Alopecurus saccatus	Pacific Foxtail			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Carex pellita	Woolly Sedge			
Castilleja campestris succulenta	Fleshy Owl's-clover	Threatened	Endangered	CRPR - 1B.2
Cephalanthus occidentalis	Common Buttonbush			
Chloropyron palmatum	NA	Endangered	SSC	CRPR - 1B.1
Cyperus acuminatus	Short-point Flatsedge			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus squarrosus	Awned Cyperus			
Downingia bella	Hoover's Downingia			
Downingia cuspidata	Toothed Calicoflower			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Elodea canadensis	Broad Waterweed			
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle		SSC	CRPR - 1B.2
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euphorbia hooveri	NA			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Hydrocotyle umbellata	Many-flower Marsh-pennywort			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			

Hypericum anagalloides	Tinker's-penny			
Juncus acuminatus	Sharp-fruit Rush			
Juncus xiphioides	Iris-leaf Rush			
Lasthenia ferrisiae	Ferris' Goldfields		SSC	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lilium pardalinum pardalinum	Leopard Lily			
Ludwigia palustris	Marsh Seedbox			
Ludwigia peploides peploides	Floating Water Primrose			Not on any status lists
Marsilea vestita vestita	Hairy Pepperwort			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Mimulus latidens	Broad-tooth Monkeyflower			
Mimulus pilosus	Snouted Monkey Flower			Not on any status lists
Mimulus tricolor	Tricolor Monkeyflower			
Myosurus minimus	Little Mouse Tail			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Orcuttia inaequalis	San Joaquin Valley Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Orcuttia pilosa	Hairy Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Persicaria hydropiperoides	Water Pepper			Not on any status lists
Persicaria lapathifolia	Common Knotweed			Not on any status lists
Persicaria punctata	Dotted Smartweed			Not on any status lists
Phalaris arundinacea	Reed Canarygrass			
Pilularia americana	Pillwort			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys distantiflorus	California Popcorn-flower			
Plagiobothrys undulatus	Coast Allocarya			Not on any status lists
Platanus racemosa	California Sycamore			
Pogogyne douglasii	Douglas' Pogogyne			
Potamogeton diversifolius	Water-thread Pondweed			
Potamogeton nodosus	Longleaf Pondweed			

Potamogeton pusillus pusillus	Slender Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Puccinellia simplex	Little Alkali Grass			
Rorippa palustris palustris	Bog Yellowcress			
Sagittaria sanfordii	Sanford's Arrowhead		SSC	CRPR - 1B.2
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Sequoia sempervirens	Coast Redwood			
Sidalcea calycosa calycosa	Annual Checker-mallow			
Tuctoria greenei	Green's Awnless Orcutt Grass	Endangered	Rare	CRPR - 1B.1
Wolffia columbiana	Columbian Watermeal			
Wolffia globosa	Asian Watermeal			
Notes: ARSSC = At-Risk Species of Special Concern BCC = Bird of Conservation Concern BSSC = Bird Species of Special Concern CRPR = California Rare Plant Rank CS = Currently Stable IUCN = International Union for Conservation of Nature SSC = Species of Special Concern				

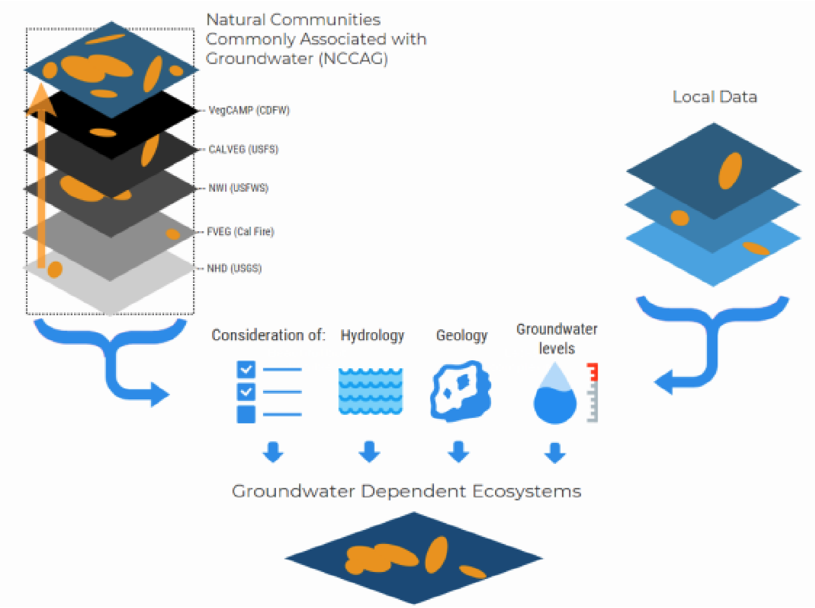
Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[6] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[7]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48

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[6] *NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/*

[7] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[8]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[9] on the Groundwater Resource Hub[10], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[8] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[9] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[10] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

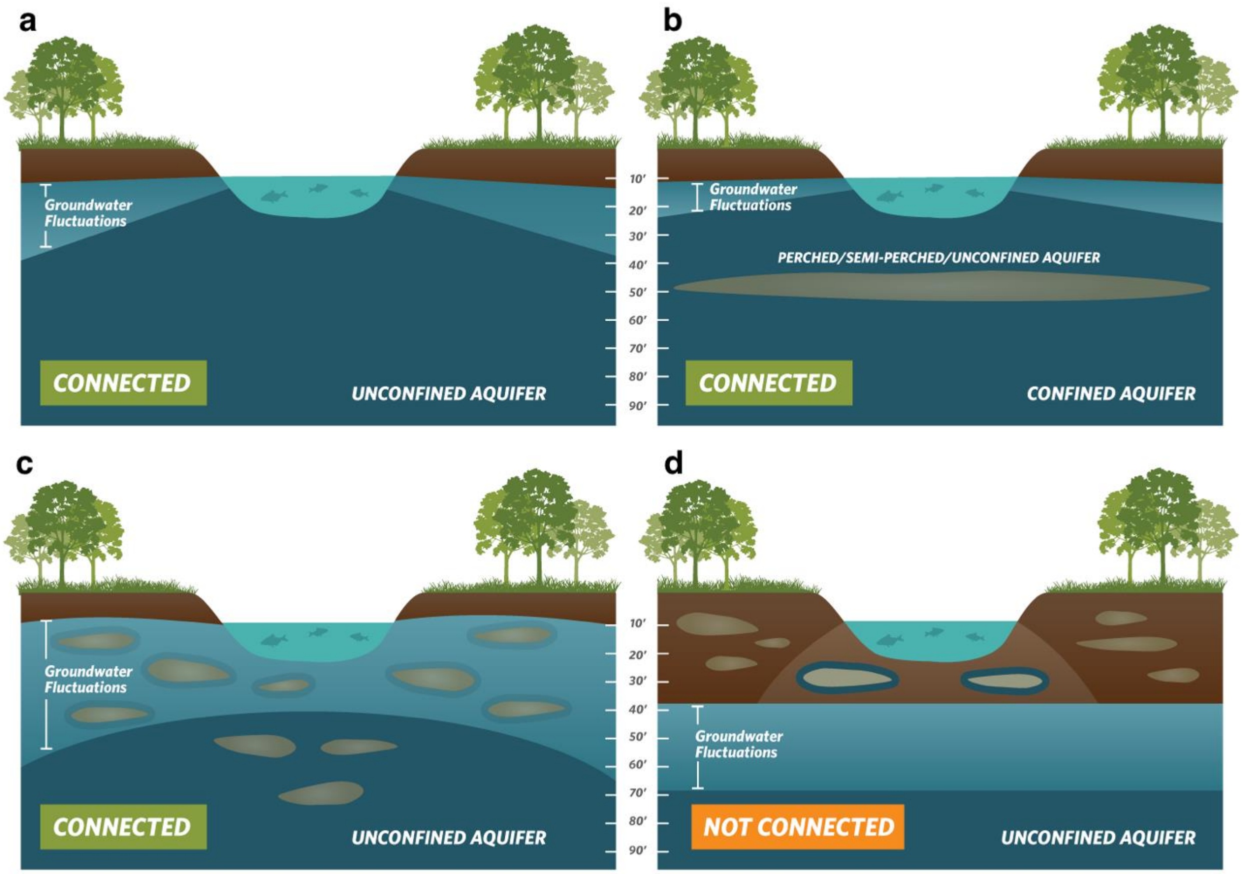

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[11] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[12] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[13] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[14]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

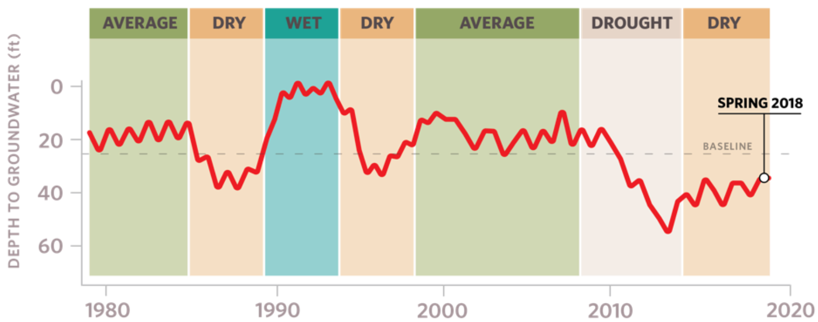

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[11] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[12] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[13] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[14] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[15], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

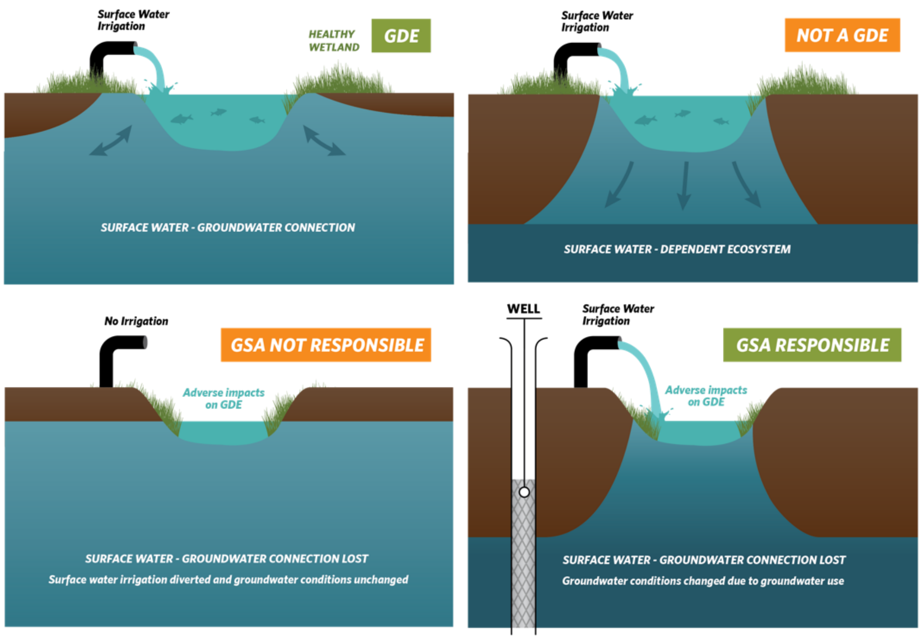

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[15] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

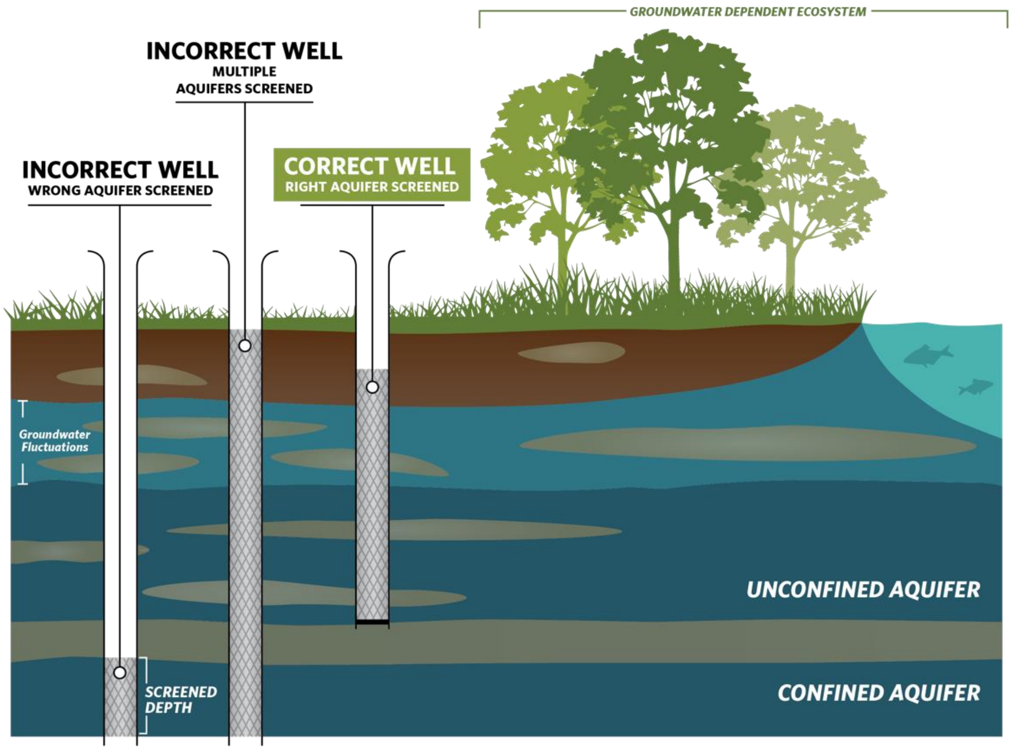


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[16] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

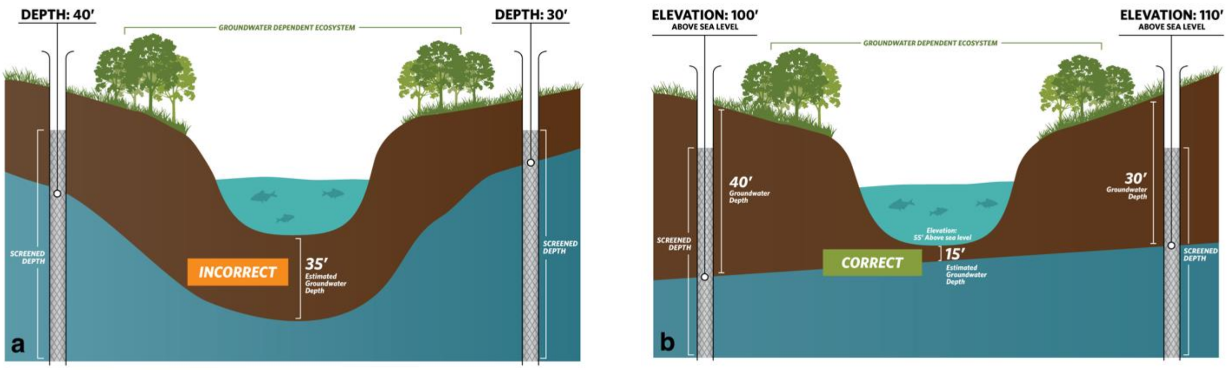


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

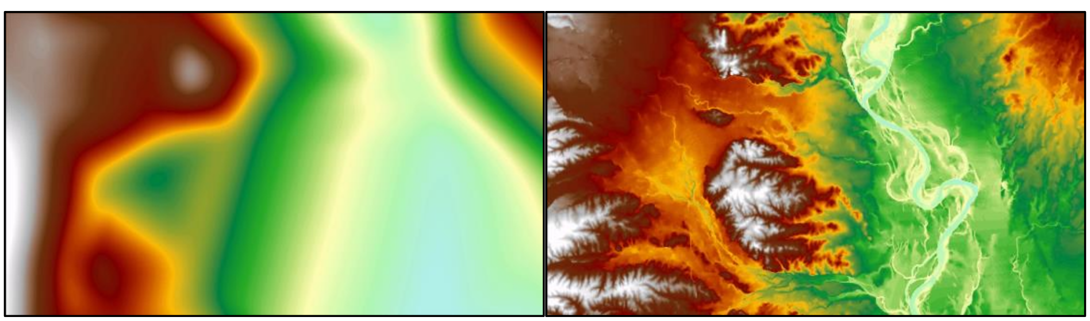


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[16] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

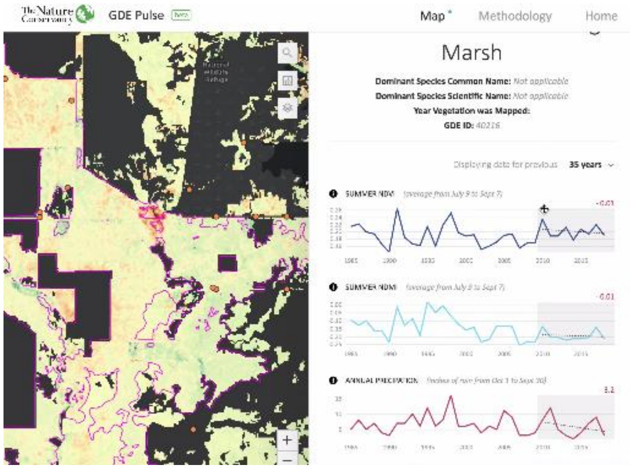
The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

Visit
https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[17]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[18]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[17] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[18] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment E

Mapping Likely Interconnected Surface Water
The Nature Conservancy, California, May 2020

Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, ISW is defined as “surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted” (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:
The groundwater elevation data, available for Spring 2011-2012, and Spring and Fall 2013-2018, comes from the California Department of Water Resources (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). These data are represented as continuous raster layers that approximates “feet above or below mean sea level” based on groundwater well measurements. According to the documentation online, groundwater level measurements were selected based on measurement date and well construction information (where available) and are intended to approximate the groundwater levels in the unconfined to uppermost semi-confined aquifers. Each of the raster layer has a different extent, but all of them are limited to the Central Valley. To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

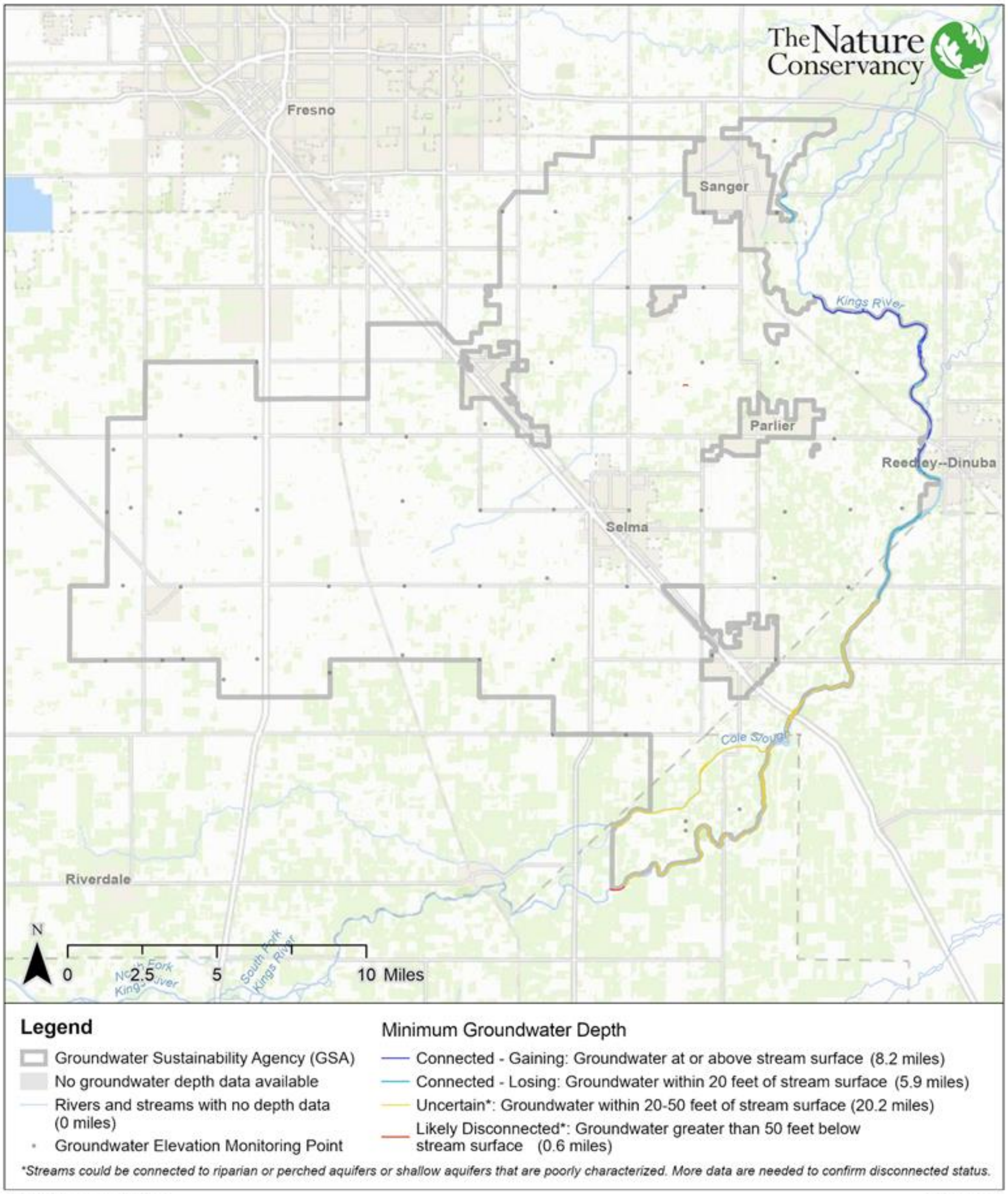
The map splits groundwater depth into four categories:

- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.
- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.

Interconnected Surface Water: Minimum Groundwater Depth (2011-2018)

Central Kings GSA GSP



5-022.08_Kings_CentralKings

Data Sources:
CA Dept. of Water Resources Groundwater Elevation Data, gis.water.ca.gov/app/gicima/
NHD Plus V2 Streams, nhdplus.com/NHDPlus/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[19]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[20]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[21] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

[19] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[20] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[21] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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nature.org
GroundwaterResourceHub.org

May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Chowchilla Subbasin Groundwater Sustainability Plan (GSP), Chowchilla Subbasin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Chowchilla Subbasin Groundwater Sustainability Agency's (GSA's) Chowchilla Subbasin Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing sustainable groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be incomplete in addressing environmental beneficial uses and users.

While the GSP addressed environmental beneficial users in some respects, our review finds that portions of the GSP should be remedied before being approved. Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address within 180 days. In these cases, we strongly recommend that the Department set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides the GSA's response to TNC's comments on the Draft GSP. Attachment G provides a map and method summary of potential ISWs.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section.

We appreciate that the GSA incorporated a portion of our feedback (21 of 41 comments were addressed), however, we disagree with the components where our feedback was ignored or dismissed. This suggests a limited degree of engagement of environmental beneficial users and could result in a definition of sustainability that is biased towards a limited set of users in the basin. In our experience, the GSP did not "adequately respond(d) to comments that raise credible technical or policy issues with the Plan," (23 CCR §355.4(b)(10).

TNC recommendation: We recommend that DWR require the GSA to prioritize stakeholder engagement, resulting in stakeholder input being incorporated into the plan. Improvements can be achieved through enhancements to the stakeholder engagement plan, partnerships with NGOs and community members, more representative governance and funding decisions.

Interconnected Surface Waters (ISWs) – The GSP incorrectly ignored potential and/or actual ISWs because the plan did not employ the best available science. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). ISWs were incorrectly removed based on the characterization that losing streams are necessarily disconnected. This justification for removal was not substantiated with further data or analysis. The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. Therefore, potential ISWs are not being managed in the GSP. Specifically, our analysis of groundwater levels from 2011 to 2018 indicate portions of the reach of the San Joaquin River that flows through the GSP area are connected (see Attachment G). Therefore, potential ISWs may have been improperly omitted.

Map and Assessment of potential ISWs:
By combining multiple years and seasons of groundwater depth data, The Nature Conservancy has determined that within the Chowchilla Subbasin GSP, 2.1 are losing and the rest are uncertain or likely disconnected. Attachment G contains a one-page method summary and a GSP-specific map of ISWs. The interconnected surface water displayed on the map is based on the minimum groundwater depth estimated by the California Department of Water Resources between 2011 and 2018.

Note: In most cases, the groundwater depth data used to generate the ISW map does not include perched aquifers. As such, some streams marked as disconnected could in actuality, be connected.

TNC recommendation: Until a disconnection can be proven, TNC recommends that the GSP include all potential and confirmed ISWs. We recommend that the GSA conduct a thorough analysis of existing data on surface water-groundwater interconnectivity and estimate the quantity and timing of streamflow depletions in the subbasin. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 986 acres of potential GDEs occur in the GSA boundary. TNC developed the Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

We were pleased to see that the GSP took steps to identify and map GDEs following TNC guidance. In particular, the San Joaquin River Riparian GDE unit was analyzed for hydrologic and ecological conditions, including an inventory of species and ecological value and a discussion of field studies and reconnaissance. TNC's GDE Pulse was used to examine NDVI and NDMI trend data for the GDE polygons within the GDE unit.

However, we found that some GDEs were improperly disregarded. We recommend that the GSP remedy the omissions by following our recommendations in Attachment B. The GSP should also revisit all components of the plan where GDEs, as a beneficial user, must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives. Our review found that NC Dataset polygons were improperly removed from the GDE map based on the following:

- GDEs were rejected on the basis that groundwater depths were greater than 30-feet. The GSA used groundwater depths from two dates (2014 and 2016), however both represent a drought period. This is a technically incorrect approach since groundwater levels fluctuate over seasonal and interannual time scales due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Justifying the removal of NC dataset polygons based on this criterion does not acknowledge that groundwater levels temporally vary and the fact that many plant species within GDEs can access groundwater depths beyond 30-feet or have adapted water stress strategies to deal with intermittent periods of deep groundwater levels. Using this methodology disregards groundwater fluctuations and can leave many GDEs unprotected in the GSP.
- GDEs located next to net-losing streams were rejected. This selected removal criteria does not necessarily prove that the plants and animals do not access groundwater, as near losing reaches groundwater gradients are close enough to the surface to support ecological communities such as riparian vegetation. Analyzing groundwater levels is a more scientifically robust approach to validate the NC dataset, since GDEs are defined as 'ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface' [23 CCR § 350(m)].

<u>TNC recommendation</u>: We request that the GSA use groundwater levels that represent interannual and inter-seasonal variability that are fully characteristic of California's climate. We recommend the use of additional information provided in our guidance document (Attachment D) to identify and consider GDEs throughout the GSP.

[1] *Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf*

Water Budget – We would like to commend the GSP for including the groundwater demands of native vegetation and managed wetlands in the historical, current and projected water budgets.

Sustainable Management Criteria – The GSP took steps towards including environmental beneficial users of groundwater and interconnected surface water, however, the Sustainable Management Criteria should be improved to describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). The GSP incorrectly states that the depletions to interconnected surface water Sustainable Management Criteria are not applicable to the subbasin, however ISWs were incorrectly removed based on characterization that losing streams are necessarily disconnected. Thus, critical habitat for threatened Central Valley steelhead and Central Valley spring-run Chinook salmon, which are beneficial users of surface water, may be adversely impacted, resulting in undesirable results.

<u>TNC recommendation</u>: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters, including steelhead and salmon. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

Monitoring Network – While the monitoring network ensures partial coverage of sustainability indicators, the network should be improved to ensure adequate coverage of sustainability indicators, characterize the spatial and temporal exchanges between surface water and groundwater, and calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions required under SGMA (23 CCR §354.34(c)(6) and (f)(3). The Monitoring Network section of the GSP currently does not address future needs for ISW monitoring, leaving data gaps on critical habitat for threatened species unprotected.

<u>TNC recommendation</u>: TNC recommends that the GSP (1) reconcile data gaps for the investigation and monitoring program including stream gauges, screened intervals and frequency of monitoring to verify the extent of ISWs; and (2) discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions as required by SGMA.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but sustainable groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto

Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Chowchilla Subbasin Groundwater Sustainability Plan

A complete draft of the Chowchilla Subbasin Groundwater Sustainability Plan (GSP), adopted in January 2020, was reviewed by TNC. Responses to comments are provided in Appendix 2.C.e of the Final GSP. The response to comments is also provided in Attachment F of this letter. We reviewed the responses to comments and the text of the Final GSP to determine if changes were made to the Final GSP text that addressed TNC's previously submitted comments. This attachment lists our original comments on the complete Public Draft GSP, as submitted to the Chowchilla Subbasin GSA during the public comment period, and states whether or not they were addressed in the Final GSP *[as green text within brackets]*. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

[Section 2.1.5.2 Description of Beneficial Uses and Users (p. 2-21)]

- *[The Environmental and Ecosystem category of interest in Table 2-4 has been expanded with the names of specific groups. Thank you for acknowledging the importance of recognizing environmental stakeholders.]* The GSP authors have listed environmental agencies and environmental groups as one of the beneficial users of groundwater in the Subbasin in Table 2-4 (p. 2-20 to 2-21). The following footnote was added to the table: "The groups and communities referenced are examples identified during initial assessment. GSA Interested Parties lists shall maintain current and more exhaustive lists of stakeholders fitting into these groups." Environmental groups should be expanded in a manner similar to the environmental justice groups in the Human Right to Water category. **Please expand the stakeholder list associated with the Environmental and Ecosystem Uses category in Table 2-4 to include the appropriate agencies and list of environmental groups**.
- *[The GSA's response states: "See Multiple Comment Subject Area Response." However, this response did not address our comment, nor were any changes made to the GSP text.]* The types and locations of environmental uses, species and habitats supported, instream flow requirements, and other designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the Subbasin should be specified. **To identify environmental users, please refer to the following**:
    - The NC Dataset (https://gis.water.ca.gov/app/NCDatasetViewer/) which identifies the potential presence of groundwater dependent ecosystems in this basin
    - The list of freshwater species located in the Chowchilla Subbasin in **Attachment C** of this letter. Please take particular note of the species with protected status.

- CDFW's California Natural Diversity Database (CNDDB) - https://www.wildlife.ca.gov/Data/CNDDB
- USFWS's IPAC report for the Chowchilla Area - https://ecos.fws.gov/ipac/
- Lands that are protected as open space preserves, habitat reserves, wildlife refuges, etc. or other lands protected in perpetuity and supported by groundwater or interconnected surface waters should be identified and acknowledged.

Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8

[Section 2.1.2.2 Surface Water Monitoring and Management Programs (p. 2-8 to 2-10)]

- *[The following text was added explanation to Section 2.1.2.2: "These monitoring stations are important for monitoring surface water available to interconnected surface water (ISW) habitats and groundwater dependent ecosystems (GDEs)." Thank you for acknowledging the importance of monitoring for ISWs and GDEs in this section.]* This section describes the types of monitoring performed by federal, state and local agencies of surface water inflows, outflows, and irrigation releases. The monitoring stations for flows and water deliveries are listed in Table 2-3. Local stations for flow or irrigation releases are listed in the text (p. 2-8 to 2-9). **Please explain the relationship of existing stream flow monitoring to the protection of ISWs and GDEs.**
- *[In Section 2.1.2.2, a footnote was added to sentences referencing the SJRRP program that described this purpose and the annual calculation of instream flow requirements (p. 2-8, 2-19). Thank you for clarifying this in the GSP.]* There is no discussion of the in-stream flow requirements for the San Joaquin River or any other surface water. The San Joaquin River Restoration Program (SJRRP) requires the release of flows from Friant Dam to the confluence with the Merced River to support the life-stages of salmon and other fish species. This section should discuss or reference any instream flow requirements, especially flow needs for critical species, including the amount, time of year when the flow minimum is specified, the duration, the species for which it applies, associated permits that set forth the requirements, and the regulating agency setting forth the compliance requirements. **Please discuss the future impact of the SJRRP on the riparian areas and potential GDEs present along or adjacent to the river.**

[Section 2.1.3.1 Madera County General Plan (p. 2-12 to 2-14)]

- *[Further description was added to Section 2.1.3.1 of the GSP. Thank you for acknowledging how General Plan policies are coordinated with protection of wetlands, aquatic resources, and other GDEs and ISWs.]* The Madera County General Plan from 1995 (with updates from 2015) includes restrictions on development in "areas with sensitive environmental resources" (Policy 1.A.5) and provides "the preservation of natural vegetation, land forms, and resources as open space, with permanent protection where feasible" (Policy 5.H.1) (p. 2-12). This section should include a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals. **Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs.**

- *[Further description was added to Section 2.1.3.1 of the GSP. Thank you for stating how implementation of the GSP will be coordinated with General Plan policies.]* The Merced County General Plan adopted in December 2013 and amended in 2016 "has established policies to promote compact development of existing or well-planned new urban communities established apart from productive agricultural land, to limit growth in rural centers, and to forbid development adjacent to wetland habitat (Policies LU-1.1-5, 7, 9-10, 13)" (p. 2-13). Agricultural land uses "shall not have a detrimental effect on surface water or groundwater resources." **Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs.**
- *[Further description added to Section 2.1.2.1 of the GSP. The PG&E San Joaquin Valley Operations & Maintenance Habitat Conservation Plan overlaps with Chowchilla Subbasin. No NCCPs overlap with the Chowchilla Subbasin (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=68626&inline).]* These sections should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin and if they are associated with critical, GDE or ISW habitats. **Please identify all relevant HCPs and NCCPs within the Subbasin and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.**
- *[The GSA's response states: "See the discussion of the San Joaquin River GDE Unit in section 2.2.2.6 for information on special status species. Also see the discussion of the GDE Monitoring Program in Section 3.5.2.5 and the GDE Appendix 2.B for more information on special species and management of critical habitat." Thank you for clarifying the location of these items in the GSP.]* Please refer to the Critical Species Lookbook[2] to review and discuss the potential groundwater reliance of critical species in the basin. **Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.**

[Section 2.1.3.4 Permitting Process for Wells in Chowchilla Subbasin (p. 2-15 to 2-16)]

- *[Further description added to Section 2.1.3.4 of the GSP. Thank you for acknowledging the importance of coordination of well permitting with the GSP's sustainability goals.]* Madera County Environmental Health Division has an online well permitting system that includes agricultural wells, observation/monitoring wells, community water supply wells, and individual domestic water supply wells. There is a requirement for new wells to "include a flow measurement device on new wells and the resulting groundwater pumping records" (p. 2-9). Other requirements follow the State standards (DWR, 1981). **Please include a discussion of how future well permitting will be coordinated with the GSP to assure achievement of the Plan's sustainability goals.**

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[2] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

- *[Further description added to Section 2.1.3.4 of the GSP. Thank you for recognizing compliance of well permitting programs with this requirement.]* The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF vs. SWRCB and Siskiyou County, No. C083239). **Compliance of well permitting programs with this requirement should be stated in the GSP.**
- *[The GSA's response states: "The potential conversion of a well designated for abandonment as a monitoring well should be handled on a case by case basis. The clear definition of Upper and Lower Aquifers that exists in the Western Management Area does not necessarily exist in the Eastern Management Area, where the Corcoran Clay becomes shallow and the Upper Aquifer is unsaturated (or only contains a thin perched aquifer) and/or the Corcoran Clay pinches out. In addition, the history of water level data at the well should also be considered." No GSP text changes were made however.]* Madera County allows wells designated for abandonment to be converted into a monitoring well. **Please clarify in the text that only wells screened in one aquifer and appropriate for monitoring will be include in the monitoring program.**

Checklist Items 5, 6, and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 2.2.1.2 Lateral and Vertical Subbasin Boundaries (p. 2-26 to 2-27)]

- *[Edits were made to the text to address this comment. Thank you for properly defining the vertical subbasin boundary.]* In the Chowchilla Subbasin, the base of the usable aquifer corresponds with the base of fresh water, generally defined as groundwater with total dissolved solids (TDS) of 1,000 milligrams per liter (mg/l) as modified from Page (1973), except in the eastern part of the basin where the of basement complex is shallower. As noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** Properly defining the bottom of the basin will prevent the possibility of extractors with wells deeper than the basin boundary from claiming exemption from SGMA due to their well residing outside the vertical extent of the basin boundary.
- *[The GSA's response states: "The referenced cross sections do show recent groundwater levels for the Upper Aquifer, which demonstrate a clear lack of surface water-groundwater connection throughout the subbasin. The depth to shallow groundwater, including the perched/mounded shallow groundwater levels along the San Joaquin River, are further illustrated in Figures 2-70 and 2-71." Please illustrate or refer to the perched/mounded shallow groundwater levels along the San Joaquin River in a cross-section diagram.]* The cross sections in Chapter 2 (Figures 2-23 through 2-33) clearly show the base of freshwater and the top of the basement rocks. However, they do not include a graphical representation of the manner in which shallow groundwater may interact with ISWs or GDEs that would allow the

reader to understand this topic. **Please include an example near-surface cross section that depicts the conceptual understanding of shallow groundwater and river interactions at different locations, as well as potential GDEs and ISWs**.

Checklist Items 8, 9, and 10 – Interconnected Surface Waters (ISWs) (23 CCR §354.16)

[Section 2.2.2.5 Groundwater-Surface Water Interaction (p. 2-41)]

- *[The GSA's response refers to the Multiple Comment Subject Area Response for ISWs. This response does not address our comment; however, text was added to the GSP on p. 2-42 that clarifies how depth to groundwater contour maps were prepared.]* The text states (p. 2-41): "A review of historical regional aquifer groundwater levels compared to stream thalweg (deepest portion of stream channel) elevations conducted for this study indicate that surface water – groundwater interactions are not a significant issue (i.e., regional groundwater levels are relatively far below creek thalweg elevations) along Chowchilla River, Ash Slough, and Berenda Slough in Chowchilla Subbasin." ISWs are best estimated by first determining which reaches are completely disconnected from groundwater. This approach would involve comparing groundwater elevations with a land surface Digital Elevation Model that could identify which surface waters have groundwater consistently below surface water features, such that an unsaturated zone would separate surface water from groundwater. **Please provide further evidence that that ISWs are not present along Chowchilla River, Ash Slough, and Berenda Slough, such as a cross-section or corresponding hydrographs to show the relationship between the river channel and the depth to groundwater at wells near the rivers.**
- *[The GSA's response refers to the Multiple Comment Subject Area Response for ISWs. This response does not address our comment; however, text was added to the GSP on p. 2-42 that clarifies how depth to groundwater contour maps were prepared.]* Figures 2-70 and 2-71 present depth to shallow groundwater for 2014 and 2016. There are large data gaps over the Chowchilla Subbasin, particularly for 2016 (Figure 2-71). **Please further describe how these figures were developed, specifically noting the following best practices for developing depth to groundwater contours presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and the subtracting this layer from land surface elevations from a DEM to estimate depth to groundwater contours across the landscape**. This will provide much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make.
- *[The GSA's response refers to the Multiple Comment Subject Area Response for ISWs. This response states: "While shallow groundwater levels rise and fall from wet to dry season and wet year to dry year and may become connected to surface water for shorter durations, defining an interconnected surface water – groundwater system should require that such a connection exists under a broader range of seasonal and climatic year conditions." This sentence demonstrates an*

interconnection, as defined by SGMA. Our comment was not addressed.] The regulations [23 CCR §351(o)] define interconnected surface waters (ISW) as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. The GSP states in several places that the San Joaquin River is losing in the section adjacent to the Subbasin, and uses this as evidence that ISWs do not exist. However, ISWs can be either gaining or losing. The defining feature of disconnected surface waters is that groundwater is consistently below surface water features such that an unsaturated zone always separates surface water from groundwater, not whether the reach is gaining or losing. **To improve ISW mapping, please reconcile data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.**

- *[The GSA's response refers to the Multiple Comment Subject Area Response for ISWs. This response states in part: "While shallow groundwater levels rise and fall from wet to dry season and wet year to dry year and may become connected to surface water for shorter durations, defining an interconnected surface water – groundwater system should require that such a connection exists under a broader range of seasonal and climatic year conditions." This sentence demonstrates an interconnection, as defined by SGMA. Our comment was not addressed.]* The GSP states (p. 2-40): "It is likely that seepage from the San Joaquin River is the source of water that combined with the presence of shallow clay layers that serves to maintain shallow groundwater levels at these locations." **Please provide estimates of current and historical surface water depletions for ISWs quantified and described by reach, season, and water year type.**

<u>Checklist Items 11 to 15, Identifying and Mapping GDEs (23 CCR §354.16)</u>

[Section 2.2.2.6 Groundwater Dependent Ecosystems (p. 2-40)]
[Appendix 2.B (Assessment of Groundwater Dependent Ecosystems)]

- *[The GSA's response states: "See Multiple Comment Subject Area Response for GDEs. A DTW cutoff of 30 feet was used as one of the primary criteria in the initial screening of potential GDEs. It was not used as a stand-alone criterion for exclusion of potential GDEs. Edits made in Section 2.2.2.6 (pg. 2-40) to further explain and clarify." The text was updated to state that GDEs located next to net-losing streams were excluded. However, this reasoning for excluding GDEs is not correct.]* The text states (p. 2-40): "A DTW cutoff of 30 feet was used in the initial screening of potential GDEs. The use of a 30-foot DTW criterion to identify potential GDEs is based on reported maximum rooting depths of California phreatophytes and is consistent with guidance provided by The Nature Conservancy (Rohde et al. 2018) for identifying potential GDEs." We have the following comments regarding this sentence and on the methodology for identifying GDEs in the Subbasin.

- *[The GSA's response states: "See Multiple Comment Subject Area Response for GDEs. Where DTW was greater than 30 feet, other criteria such as river hydrology (flow permanence and gaining vs. losing reaches) and dominant vegetation were used to determine whether potential GDEs should be considered as final GDEs. Screening of potential GDEs also included field evaluation of potential GDEs where initial uncertainty was high. Edits made in Section 2.2.2.6 (pg. 2-40) to further explain and clarify." The text was updated to state that GDEs located next to net-losing streams were excluded. However, this reasoning for excluding GDEs is not correct.] 30-ft criteria from TNC Guidance:* In TNC's GDE Guidance, the depth criterion of 30 feet is presented as a criterion for inclusion, not a standalone criterion for exclusion. In other words, if groundwater is within 30 feet of the ground surface, then a GDE can be identified. **If it is not, then further analysis must be conducted (see Appendix III of the GDE Guidance, Worksheet 1, for other indicators of GDEs).**
- *[The GSA's response states: "Comment noted. Our analysis considered all available data on vegetation rooting depth and the importance of capillary action, as well as recent published research indicating variability in rooting depth according to local topography and groundwater conditions."] 30-ft as maximum rooting depths of California phreatophytes:* Please use care when considering rooting depths of vegetation. While Valley Oak (*Quercus lobata*) have been observed to have a max rooting depth of ~24 feet (https://groundwaterresourcehub.org/gde-tools/gde-rooting-depths-database-for-gdes/), rooting depths are likely to spatially vary based on the local hydrologic conditions available to the plant. Also, max rooting depths do not take capillary action into consideration, which will vary with soil type and is an important consideration since woody phreatophytes generally do not like to have their roots submerged in groundwater for extended periods of time, and hence can access groundwater at deeper depths. In addition, while it is likely to be true that shallow water availability is necessary to support the recruitment of saplings, hydraulic lift of groundwater to shallow depths has been observed in *Quercus* spp.
- *[The GSA's response states: "See Multiple Comment Subject Area Response for GDEs. The 2014 and 2016 DTW data were the most accurate and recent DTW data available for the Chowchilla Subbasin. While the 2016 data represent conditions after the 2015 SGMA baseline, the use of shallow groundwater data from both years was deemed appropriate because it provided a more conservative (i.e., more inclusive) indicator of potential GDEs than the use of a data from a single year. Omitting 2016 data as suggested by TNC would reduce the number and extent of potential GDEs. Edits made in Section 2.2.2.6 (pg. 2-40) to justify the use of both 2014 and 2016 data." A comparison of depth to groundwater in 2014 and 2016 (Figures 2-70 and 2-71) show that depth to groundwater has increased during this time period. Because depth to groundwater was greater in 2016, this would be a <u>less</u> inclusive condition and thus the reasoning provided in this response is not valid.] Use of depth to water maps from 2014 and 2016:*

- 2016 is after the SGMA benchmark date of January 1, 2015. **Please rely on groundwater condition data prior to the SGMA benchmark date.**
- **We highly recommend using depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network.** While depth to groundwater levels within 30 feet are generally accepted as being a proxy for confirming that polygons in the NC dataset are connected to groundwater, it is highly advised that seasonal and interannual groundwater fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one or two points in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Based on a study we recently submitted to Frontiers in Environmental Science Journal, we've observed riparian forests along the Cosumnes River to experience a range in groundwater levels between 1.5 and 75 feet over seasonal and interannual timescales. Seasonal fluctuations in the regional water table can support perched groundwater near an intermittent river that seasonally runs dry due to large seasonal fluctuations in the regional water table. While perched groundwater itself cannot directly be managed due to its position in the vadose zone, the water table position within the regional aquifer (via pumping rate restrictions, restricted pumping at certain depths, restricted pumping around GDEs, well density rules) and its interactions with surface water (e.g., timing and duration) can be managed to prevent adverse impacts to ecosystems due to changes in groundwater quality and quantity under SGMA.

- *[The GSA's response states: "See Multiple Comment Subject Area Response for GDEs." This response does not address our comment; however, text was added to the GSP on p. 2-42 that clarifies how depth to groundwater contour maps were prepared.]* **Please provide more details on how depth to groundwater contour maps were developed (Figures 2-70 and 2-71)**:
  - Are the wells used for interpolating depth to groundwater sufficiently close (<5km) to NC Dataset polygons to reflect local conditions relevant to ecosystems?
  - Are the wells used for interpolating depth to groundwater screened within the surficial unconfined aquifer and capable of measuring the true water table?

- Is depth to groundwater contoured using **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape? This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[3] to estimate depth-to-groundwater contours across the landscape. This will provide much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make. It is better to assume that water surface elevations are constant in between wells, and then calculate depth to groundwater using a DEM of the land surface to contour depth to groundwater.

- *[The GSA's response states: "See Multiple Comment Subject Area Response for GDEs." However, this response does not address retaining NC dataset polygons where data gaps exist.]* The depth to groundwater contour maps (Figures 2-70 and 2-71) show large areas of data gaps, given the marked data points on the map where data exists. These maps were used to exclude all GDEs located adjacent to Chowchilla River, Ash Slough, and Berenda Slough (Figure 1 of Appendix 2.B). **As stated above, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network.**

<u>Checklist Items 16 to 20, Describing GDEs (23 CCR §354.16)</u>

[Appendix 2.B (Assessment of Groundwater Dependent Ecosystems)]

- *[No response required.]* TNC acknowledges and appreciates the comprehensive evaluation of the San Joaquin River Riparian GDE unit following our guidance, including analyzing hydrologic conditions, ecological conditions, providing an inventory of species and ecological value, along with concurrent field studies and reconnaissance. We also appreciate the use of TNC's GDE Pulse to examine NDVI and NDMI trend data for the GDE polygons within the GDE unit.

<u>Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)</u>

[Section 2.2.3 Water Budget Information (p. 2-45 to 2-99)]

- *[The GSA's response states: "Evapotranspiration from groundwater by riparian vegetation is included in the evapotranspiration of native vegetation. Riparian vegetation is not included in the list of water use sectors requiring separate quantification by the GSP regulations. The GSP regulations require that outflow be quantified by water use sector defined as "categories of water demand based on the general land uses to which the water is applied, including urban, industrial,*

[3] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

agricultural, managed wetlands, managed recharge, and native vegetation." Thank you for clarifying that riparian vegetation is included in the native vegetation category.] The text states (p. 2-79): "…while for native vegetation lands, groundwater extraction by riparian vegetation was considered to be negligible because of the depth to groundwater in the subbasin." **Because there are potential GDEs included in the Chowchilla Subbasin, please quantify the evapotranspiration from groundwater by riparian vegetation even if small. Please revise the text and budget as necessary.**

Checklist Items 23 to 25 – Sustainability Goal (23 CCR §354.24)

[Section 3.1 Sustainability Goal (p. 3-2)]

- *[The GSA's response states: "Comment noted. The sustainability goal was discussed in public meetings and incorporates feedback received by GSAs from stakeholders during public meetings." Our comment was not addressed.]* The sustainability goal does not specifically mention beneficial uses or users of groundwater, including environmental users. It states "the six sustainability indicators, established measurable objectives, and minimum thresholds will ensure that no undesirable results of significant and unreasonable economic, social, or environmental impacts occur…" **Please rephrase the Sustainability Goal to specifically call out beneficial uses and users of groundwater including environmental users. Please state how the sustainability of environmental uses will be protected. In addition, a statement about any intention to address pre-SGMA impacts should be included.**

Checklist Item 26 – Measurable Objectives (23 CCR §354.30)

[Section 3.2.5 Measurable Objectives for Depletion of Surface Water (p. 3-21)]

- *[The GSA's response refers to the Multiple Comment Subject Area Response for ISWs. This response states in part: "While shallow groundwater levels rise and fall from wet to dry season and wet year to dry year and may become connected to surface water for shorter durations, defining an interconnected surface water – groundwater system should require that such a connection exists under a broader range of seasonal and climatic year conditions." This sentence illustrates a fundamental misunderstanding of an ISW. Our comment was not addressed.]* The GSP states (p. 3-5): "Groundwater in the GDE unit is tightly coupled with surface flow and runoff and is generally maintained at depths within the maximum rooting depth range of the dominant phreatophytic species present in the unit (see Section 2.2.2). The groundwater that is potentially accessible to the vegetation composing the GDE unit likely occurs as a shallow perched/mounded aquifer fed largely by percolation of surface flow from the San Joaquin River. As described in Section 2.2.5 [should be 2.2.2.5], it has been determined that a connection between regional groundwater and streams does not currently exist in the subbasin." However, Section 2.2.2.5 does not present evidence that ISWs do not exist in the Subbasin, and states that a historical connection between groundwater and the San Joaquin River did exist through 2008.

- *[The GSA's response refers to the Multiple Comment Subject Area Response for ISWs. This response states in part: "While shallow groundwater levels rise and fall from wet to dry season and wet year to dry year and may become connected to surface water for shorter durations, defining an interconnected surface water – groundwater system should require that such a connection exists under a broader range of seasonal and climatic year conditions." This sentence illustrates a fundamental misunderstanding of an ISW. Our comment was not addressed.]* The GSP fails to establish measurable objectives or minimum thresholds for this sustainability indicator. The existence of riparian GDEs along the streams in the basin has been identified in Appendix 2.B, and their connection to groundwater is assumed. Their occurrence in the riparian zone means that these GDEs should be considered a beneficial user of groundwater that could be affected by chronic groundwater level decline as discussed above, as well as beneficial users of surface water that could be depleted by groundwater extraction. **A more robust discussion of the known facts regarding these surface-groundwater interactions in the riparian zone should be provided. In addition, more detailed discussion regarding specific data gaps should be included.**
- *[Edits made to Section 3.2.5 (pg. 3-21) referring to Appendix 2.B address our comment.]* There is a need to evaluate and discuss potential effects on beneficial uses of surface and groundwater. In addition, the applicable state, federal and local standards for the protection of aquatic, riparian and other protected habitats should be discussed. This is necessary, at a minimum, so that the nature of the data gaps can be understood. **Please refer to Attachment C for a list of freshwater species in Chowchilla Subbasin that may be exist within ISWs. We recommend that after identifying which freshwater species exist in your basin, especially federal and state listed species, that you contact staff at the Department of Fish and Wildlife (DFW), United States Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Services (NMFS) to obtain their input on the groundwater and surface water needs of the organisms on the freshwater species list. Because effects to plants and animals are difficult and sometimes impossible to reverse, we recommend erring on the side of caution to preserve sufficient groundwater conditions to sustain GDEs and ISWs. Please refer to the Critical Species Lookbook[4] to review and discuss the potential groundwater reliance of critical species in the basin.**
- *[The GSA's response states: "The GSP has determined that ISWs are not present." However, the Multiple Comment Subject Area Response for ISWs states: "While shallow groundwater levels rise and fall from wet to dry season and wet year to dry year and may become connected to surface water for shorter durations, defining an interconnected surface water – groundwater system should require that such a connection exists under a broader range of seasonal and climatic year conditions." This sentence illustrates a fundamental misunderstanding of an ISW. Our comment was not addressed.]* The analysis for ISWs should include all beneficial users of surface water that could be affected by groundwater withdrawals, including

[4] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

environmental. Refer to the San Joaquin River Restoration Program (SJRRP) that identifies instream flow needs for salmon. **Please include instream flow requirements in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

<u>Checklist Item 27-29 – Minimum Thresholds (23 CCR §354.28</u>)

[Section 3.3.1 Minimum Thresholds for Lowering of Groundwater Levels (p. 3-22)]

- *[The GSP was revised accordingly.]* Please correct the call-out on p. 3-23 to Appendix 6.D (it should be 2.B).
- *[The GSA's response states: "The GSP text, maps, and figures describe RMS sites being designated as representative of the Upper Aquifer, Lower Aquifer, or both (composite). Composite wells were minimized to the extent possible, and were only included if no other suitable RMS were available specific to the Upper or Lower Aquifer only. Nested well sites are currently being installed to fill data gaps." For clarity please add this explanation to the GSP text.]* The text states (p. 3-23): "The minimum thresholds for chronic lowering of groundwater levels are based on selection of RMS from among existing production and monitoring wells located throughout the subbasin and screened in both in the Upper and Lower Aquifers." Please clarify the text to state that wells were chosen that monitor a single aquifer, but not both at the same time (i.e. composite), if that is the intended meaning.

[Section 3.3.4 Minimum Thresholds for Degraded Water Quality (p. 3-35)]

- *[The GSA's response states: "In general, meeting municipal and domestic water quality MO/MT is expected to be protective of GDEs. It should also be noted that the GSP is not responsible for existing constituent levels or ongoing non-GSP related activities that may result in increasing constituent concentrations. As described in the GSP, there are many other agencies/programs devoted to monitoring and protection of groundwater quality, with which the GSAs plan to coordinate." For clarity please add this explanation to the GSP text.]* This Minimum Threshold does not consider water quality needs of GDEs. The text states (p. 3-36): "Protection of municipal and domestic beneficial uses is also protective of all other groundwater beneficial uses." **Please elaborate on this statement and include a discussion about GDEs and water quality and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Section 3.3.5 Minimum Thresholds for Depletion of Surface Water (p. 3-40)]

- *[The GSA's response refers to the Multiple Comment Subject Area Response for ISWs. This response states in part: "While shallow groundwater levels rise and fall from wet to dry season and wet year to dry year and may become connected to surface water for shorter durations, defining an interconnected surface water – groundwater system should require that such a connection exists under a broader* *range of seasonal and climatic year conditions." This sentence illustrates a fundamental misunderstanding of an ISW. Our comment was not addressed.]* The text states (p. 3-40): "Therefore, the surface water depletion sustainability criteria is not applicable to the subbasin." However, no evidence is provided in the GSP to show that a hydraulic connection between groundwater and surface water does not exist. **Following the discussion presented above for Checklist Item 26 (Measurable Objectives), please include a discussion of Sustainable Management Criteria for ISWs, including Minimum Thresholds, in the GSP. Please cite data gaps regarding ISWs and make plans to reconcile them in the Monitoring Section of the GSP.**

Checklist Item 30-46 – Undesirable Results (23 CCR §354.26)

[Section 3.4 Undesirable Results (p. 3-40)]

- *[The GSA's response states: "This section, in particular Table 3-8, describes undesirable results in terms of physical groundwater parameters. How these groundwater parameters relate to beneficial uses of groundwater are described in other sections. The relation to environmental beneficial uses is described in the sections and appendix that describe the GDE analysis completed." For clarity please add this to the GSP text.]* This section only describes undesirable results relating to human beneficial uses of groundwater and neglects environmental beneficial uses that could be adversely affected by chronic groundwater level decline. **Please add "potential adverse impacts to GDEs" to the list of potential undesirable results presented in Table 3-8 (p. 3-41).**

[Section 3.4.1 Undesirable Results for Lowering of Groundwater Levels (p. 3-42)]

- *[The GSA's response states: "GDEs are not one of the six sustainability indicators designated under SGMA and GSP regulations. However, GDEs were considered in detail in the GSP and specific GDE RMS sites incorporated in the Plan." While we do acknowledge and appreciate the comprehensive evaluation of the San Joaquin River Riparian GDE Unit in the GSP, this response does not address our comment regarding the use of management areas.]* The GSP states (p. 3-42): "Using the Fall measurements (assumed to be collected in October), a groundwater elevation undesirable result is defined to occur when greater than 30% of the RMS [representative monitoring sites] each exceed the groundwater level minimum thresholds for the same two consecutive Fall readings. Given a total of 36 RMS sites, a total of 11 or more the RMS would need to exceed MTs as defined above to constitute an undesirable result for chronic lowering of groundwater levels." The use of 30 percent to define an undesirable result does not allow for the occurrence of low water levels in one area, such as near a GDE, to be an Undesirable Result, which may impact environmental beneficial use. There are three RMS near the San Joaquin River Riparian GDE unit, which could be evaluated separately. **Please consider the use of a separate management area for the San Joaquin River Riparian GDE unit so that different sustainable management criteria can be established for this GDE unit.**

[Sections 3.4.4 Undesirable Results for Degraded Water Quality (p. 3-44)]

- *[The GSA's response states: "Arsenic is included as one of the key constituents for which MT and MO have been set. The GSP accounts for arsenic regardless of the mechanism by which the concentrations may increase, provided that increase in concentrations is caused by GSP projects/management actions." For clarity please add this discussion to the GSP text.]* This section describes undesirable results in terms of meeting drinking water standards. The following is a link to a paper by Smith, Knight and Fendorf (2018) titled "Overpumping leads to California groundwater arsenic threat": (https://www.nature.com/articles/s41467-018-04475-3). **The section should be modified to state that overpumping and dewatering of aquitards has been identified as a potential source of elevated arsenic concentrations above drinking water standards in San Joaquin Valley aquifers. In addition, any potential undesirable results from degradation of water quality that may impact GDEs and freshwater species in the area should be discussed in this section.**

[Sections 3.4.5 Undesirable Results for Depletion of Surface Water (p. 3-45)]

- *[The GSA's response refers to the Multiple Comment Subject Area Response for ISWs. This response states in part: "While shallow groundwater levels rise and fall from wet to dry season and wet year to dry year and may become connected to surface water for shorter durations, defining an interconnected surface water – groundwater system should require that such a connection exists under a broader range of seasonal and climatic year conditions." This sentence illustrates a fundamental misunderstanding of an ISW. Our comment was not addressed.]* **Following the discussion presented above for Checklist Item 26 (Measurable Objectives), please include a discussion of Sustainable Management Criteria for ISWs, including Undesirable Results, in the GSP. Please cite data gaps regarding ISWs and make plans to reconcile them in the Monitoring Section of the GSP.**

<u>Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)</u>

[Section 3.5 Monitoring Network (p. 3-45)]

- *[The GSA's response states: "There is extensive discussion in the GSP regarding groundwater levels and GDEs, and specific RMS sites were selected to represent GDEs. See Multiple Comment Response Section regarding ISWs." Please further elaborate on how monitoring data will be used to estimate the quantity and timing of streamflow depletions for ISWs, as required by SGMA.]* Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater <u>*and related surface conditions*</u> (emphasis added). Groundwater level monitoring alone may be insufficient to establish a linkage between groundwater extraction and potentially resulting impacts to environmental resources associated with GDEs and ISWs. The cause-effect relationship between groundwater levels and the biological responses that could result in significant and unreasonable impacts to ISWs and GDEs depends on a number of complicated factors, and this relationship is not characterized or discussed. The Monitoring Network section currently does not address future needs for ISW monitoring. In this section, please describe monitoring for ISWs as described below:

- In addition to the need for additional shallow monitoring wells in the upper aquifer to map GDEs, **there is also a need to enhancing monitoring of stream flow and vertical groundwater gradients by installing more stream gauges and clustered/nested wells near streams, rivers or wetlands.** Ideally, co-locating stream gauges with wells that can monitor groundwater levels in both the upper and lower aquifers would enhance understanding about where ISWs exist in the basin and whether pumping is causing depletions of surface water or impacts on beneficial users of surface water and groundwater. **Please provide sufficient detail for the investigation and monitoring program including stream gauges, screened intervals and frequency of monitoring, in order to describe monitoring of both the extent of ISWs and the quantity of surface water depletions from ISWs.**

[Section 3.5.1.1 Groundwater Level Monitoring Program (p. 3-47)]

- *[The GSA's response states: "Additional nested monitoring wells, including shallow Upper Aquifer wells are currently being installed. Additional analyses will be conducted related to GDEs and ISW for the 5-year update based on additional data collected during the next five years." There are large areas in the center of the subbasin where data gaps remain unfilled. Please retain GDEs located near these streams until data gaps are filled.]* As noted in our comments above on Checklist Items 11-15, the depth to groundwater contour maps (Figures 2-70 and 2-71) show large areas of data gaps, given the marked data points on the map where data exists. These maps were used to exclude all GDEs located adjacent to Chowchilla River, Ash Slough, and Berenda Slough (Figure 1 of Appendix 2.B). **Please propose additional upper aquifer wells to reconcile this data gap.**

<u>Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)</u>

[Section 4 Projects (p. 4-1)]

- *[Edits were made in Section 4 (pg. 4-1) and text on pg. 4-7 that provide an example of benefits of recharge basins. Thank you for further defining the benefits of recharge basins.]* The Subbasin area includes GDEs and ISWs that are beneficial uses and users of groundwater, and may include potentially sensitive resources and protected lands. Protection of environmental uses and users should be considered in establishing project priorities. In addition, consistent with existing grant and funding guidelines for SGMA-related work, priority should be given to multi-benefit projects that can address water quantity as well as providing environmental benefits or benefits to disadvantaged communities. **Please include environmental benefits and multiple benefits as criteria for assessing project priorities.**
- *[GSP edits were made in Section 4.1.1.5 (pg. 4-7) stating that in addition to the proposed projects/management actions in the GSP, it should be noted that the San*

Joaquin River Restoration Project, which reduces diversions available for irrigation, will provide a major source of new water to support GDEs along the San Joaquin River.] This section identifies many important projects; however, the descriptions of Measurable Objectives for these projects only identifies benefits to water level and storage. **Because maintenance or recovery of groundwater levels, or construction of recharge facilities, may have potential environmental benefits in many cases it would be advantageous to demonstrate multiple benefits from a funding and prioritization perspective.**

- **For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.**
- If ISWs will not be adequately protected by those listed, **please include and describe additional management actions and projects targeted for protecting ISWs.**
- Recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such facilities have been incorporated into local Habitat Conservation Plans (HCPs) and Natural Community Conservation Plans (NCCPs), more fully recognizing the value of the habitat that they provide and the species they support. For projects that construct recharge ponds, **please consider identifying if there is habitat value incorporated into the design and how the recharge ponds can be managed as multiple-benefit projects that have a benefit to environmental users. Grant and funding opportunities for SGMA-related work may apply to multi-benefit projects that can address water quantity as well as provide environmental benefits.**
- For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

Attachment C

Freshwater Species Located in the Chowchilla Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Chowchilla Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the Chowchilla groundwater basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[5]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[6] as well as on The Nature Conservancy's science website[7].

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
BIRD				
Actitis macularius	Spotted Sandpiper			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			

[5] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[6] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[7] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Cistothorus palustris palustris	Marsh Wren			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			

Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEAN				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Branchinecta mesovallensis	Midvalley Fairy Shrimp		Special	
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangere d
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
FISH				
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Cottus asper ssp. 1	Prickly sculpin			Least Concern - Moyle 2013
Lampetra hubbsi	Kern brook lamprey		Special Concern	Vulnerable - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		Special	Near-Threatened - Moyle 2013
Mylopharodon conocephalus	Hardhead		Special Concern	Near-Threatened - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus tshawytscha - CV fall	Central Valley fall Chinook salmon	Species of Special Concern	Special Concern	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV late fall	Central Valley late fall Chinook salmon	Species of Special Concern		Endangere d - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
HERP				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC

Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECT & OTHER INVERT				
MAMMAL				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSK				
Anodonta californiensis	California Floater		Special	
Margaritifera falcata	Western Pearlshell		Special	
PLANT				
Callitriche longipedunculata	Longstock Water-starwort			
Castilleja campestris succulenta	Fleshy Owl's-clover	Threatened	Endangered	CRPR - 1B.2
Chloropyron palmatum	NA	Endangered	Special	CRPR - 1B.1
Crassula aquatica	Water Pygmyweed			
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle		Special	CRPR - 1B.2
Lasthenia fremontii	Fremont's Goldfields			
Myosurus minimus	NA			
Orcuttia inaequalis	San Joaquin Valley Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Phacelia distans	NA			
Pilularia americana	NA			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			

Attachment D

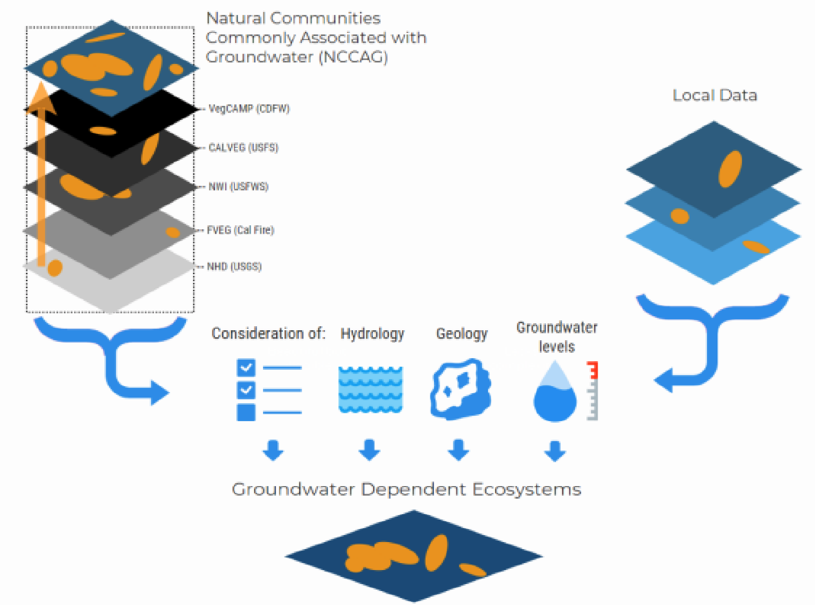
The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[8] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[9]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[8] *NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/*

[9] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[10]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[11] on the Groundwater Resource Hub[12], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[10] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[11] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[12] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

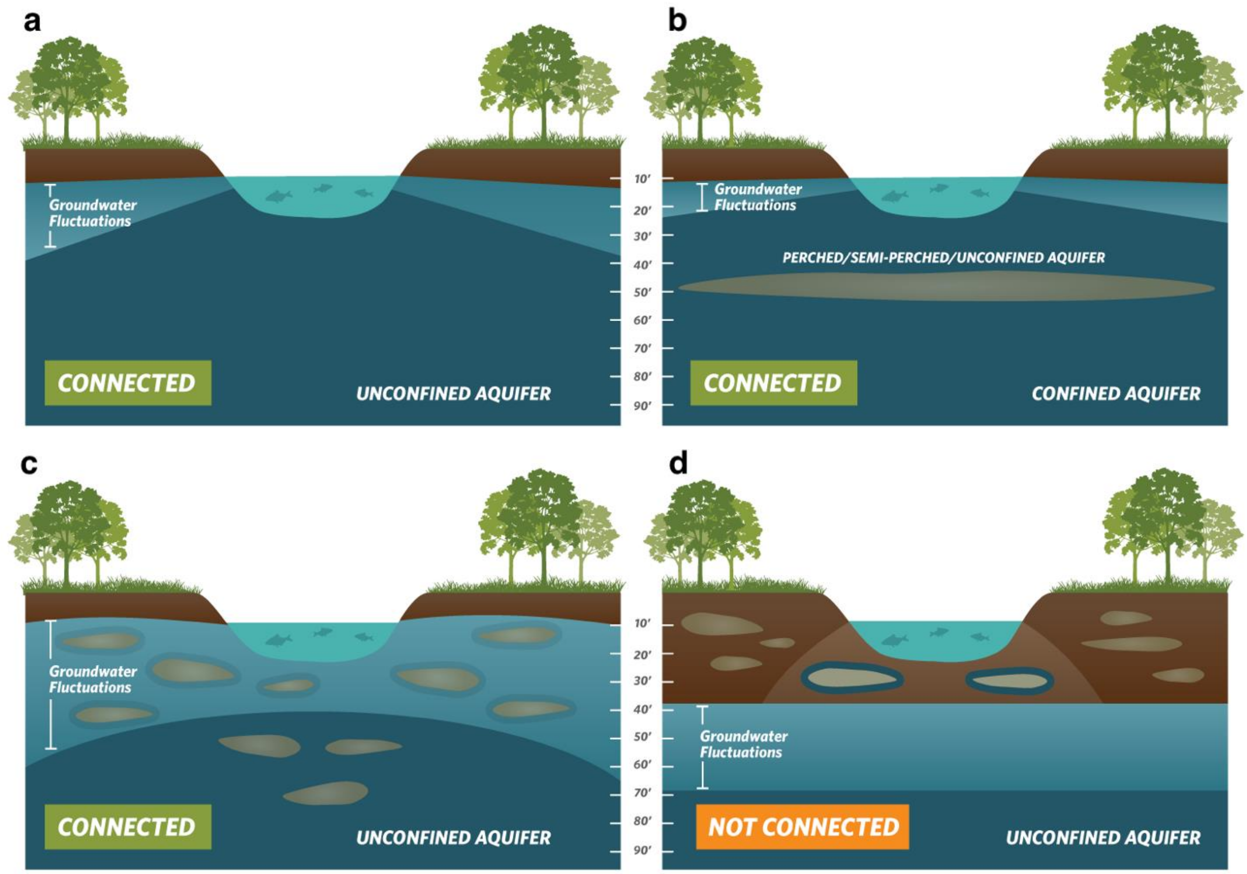

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[13] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[14] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[15] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[16]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network (see Best Practice #6).

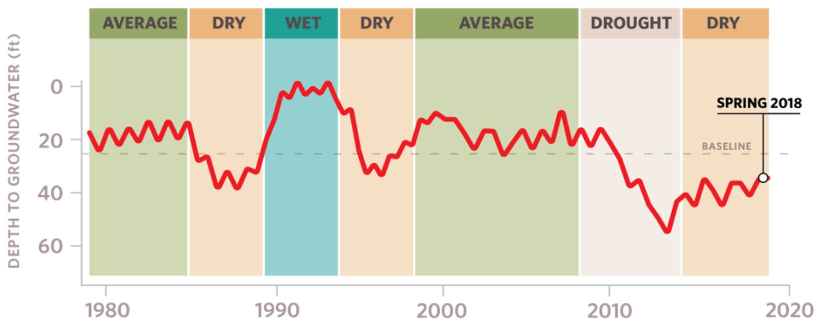

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[13] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[14] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[15] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[16] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[17], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

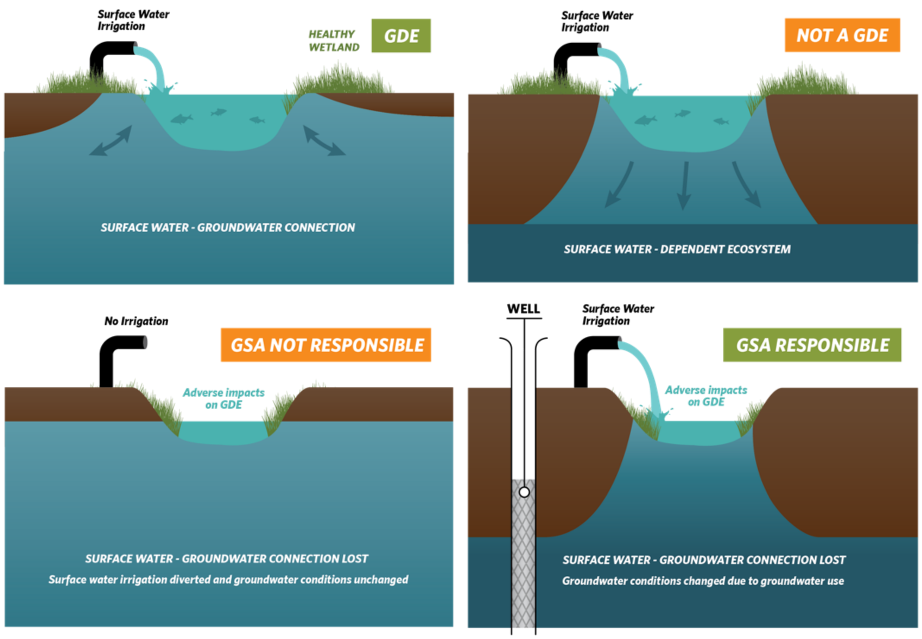


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[17] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

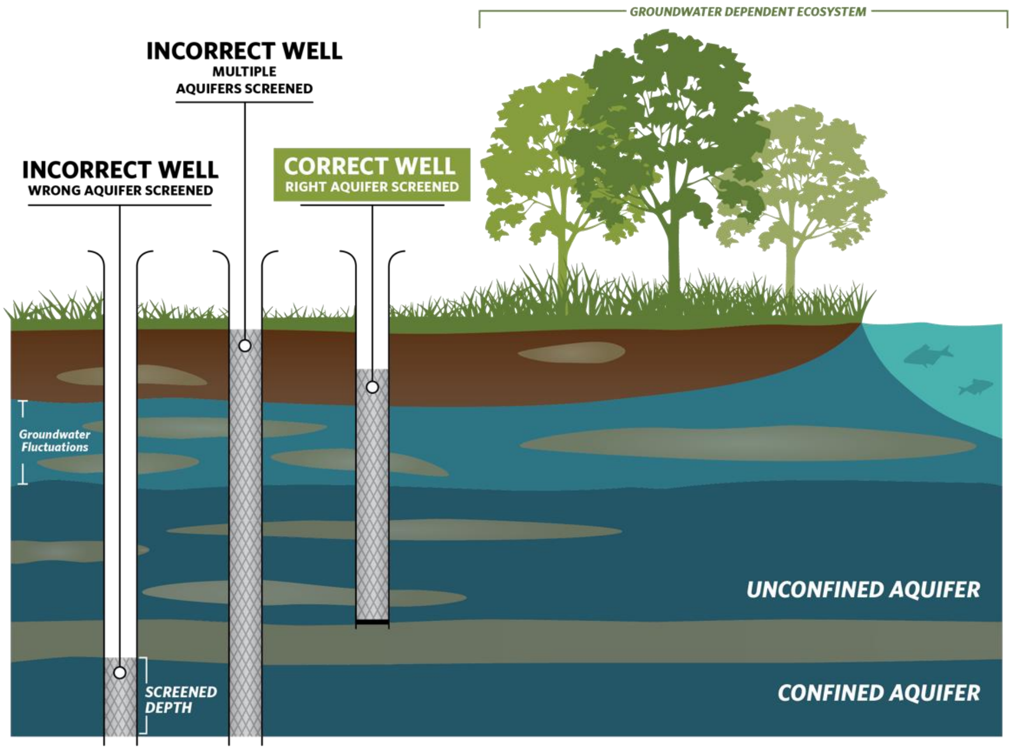


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[18] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

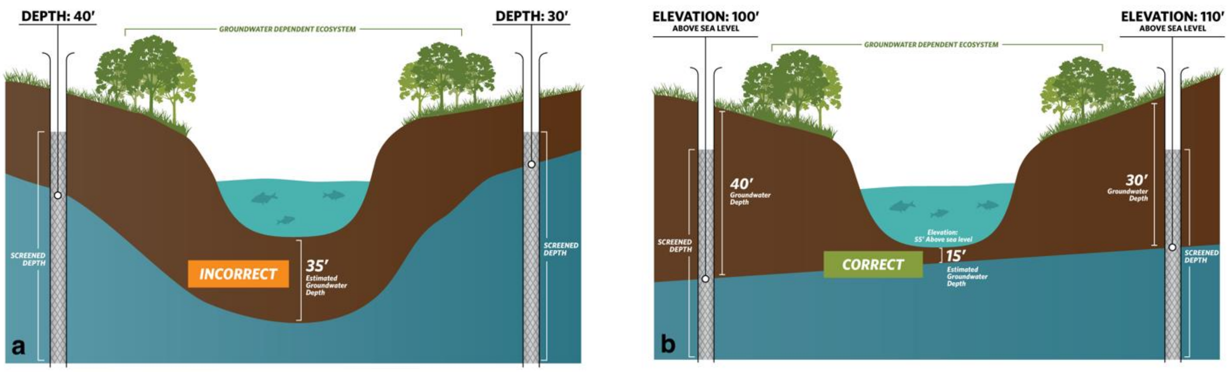


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

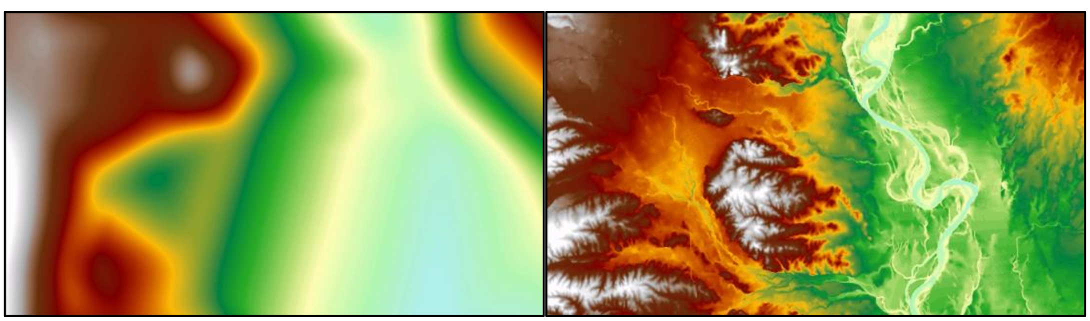


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[18] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment F

The GSA Response to TNC Comments on the Draft GSP can be found on DWR’s SGMA portal as attachment 2 of 2.

Attachment G

Mapping Likely Interconnected Surface Water
The Nature Conservancy, California, May 2020

Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, ISW is defined as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:
The groundwater elevation data, available for Spring 2011-2012, and Spring and Fall 2013-2018, comes from the California Department of Water Resources (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). These data are represented as continuous raster layers that approximates "feet above or below mean sea level" based on groundwater well measurements. According to the documentation online, groundwater level measurements were selected based on measurement date and well construction information (where available) and are intended to approximate the groundwater levels in the unconfined to uppermost semi-confined aquifers. Each of the raster layer has a different extent, but all of them are limited to the Central Valley. To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

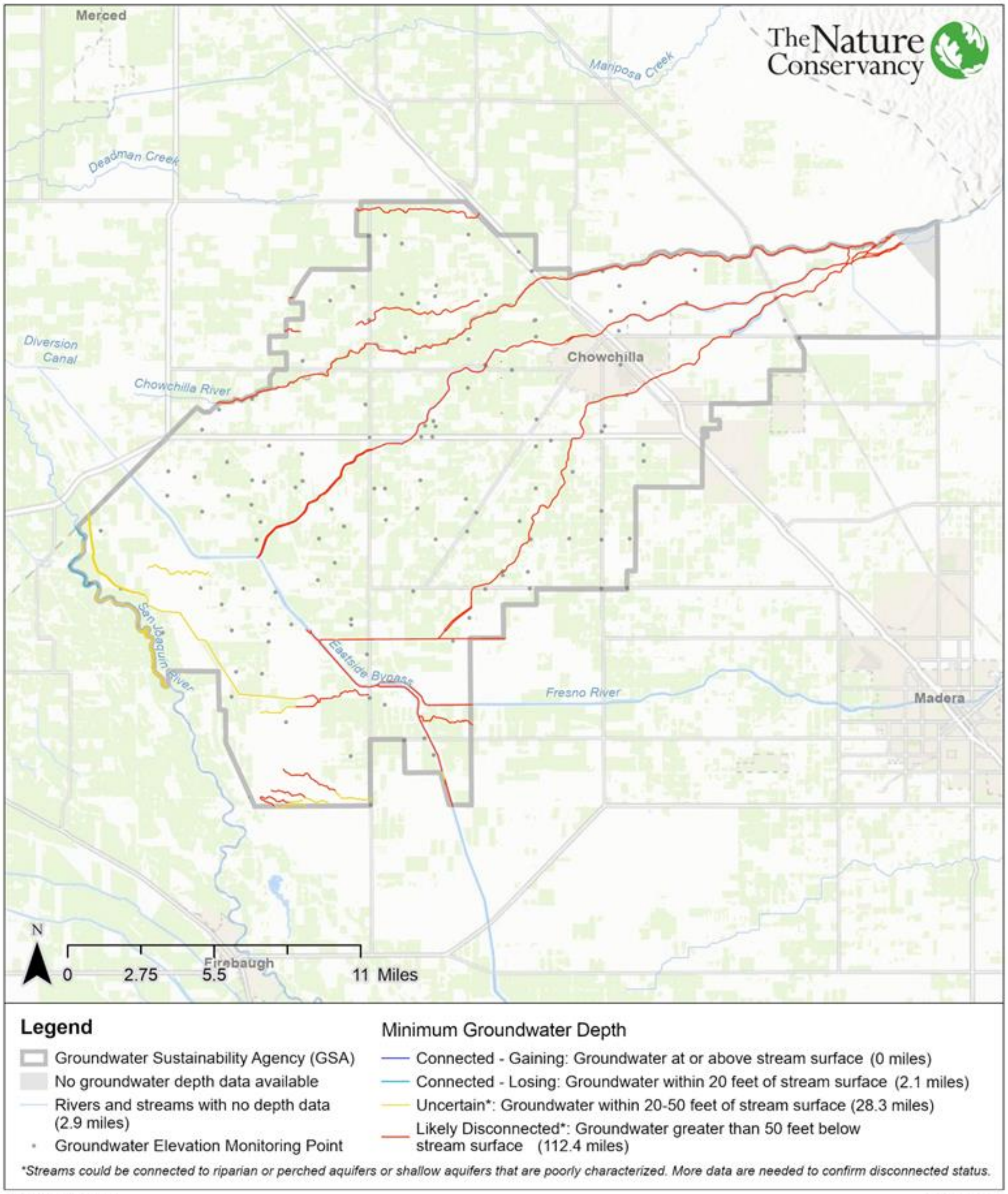
The map splits groundwater depth into four categories:

- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.
- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.

Interconnected Surface Water: Minimum Groundwater Depth (2011-2018)

Chowchilla Subbasin GSP



5-022.05_Chowchilla

Data Sources:
CA Dept. of Water Resources Groundwater Elevation Data, gis.water.ca.gov/app/gicima/
NHD Plus V2 Streams, nhdplus.com/NHDPlus/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[19]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[20]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[21] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[19] https://www.ncbi.nlm.nih.gov/pubmed/12753220
[20] Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009
[21] Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015

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nature.org
GroundwaterResourceHub.org

May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Grassland Groundwater Sustainability Plan (GSP), Delta Mendota Subbasin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Grassland Groundwater Sustainability Agency's (GGSA's) Grassland Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing *sustainable* groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be sufficient in addressing environmental beneficial uses and users.

We would like to compliment the GGSA for their treatment of environmental beneficial users in the GSP. We believe the GGSA sufficiently addressed environmental beneficial users in this first GSP submission. In the spirit of continual improvement embedded in SGMA, we would like to offer the following input as areas for improvement in the next version of the GSP.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides a map and method summary of ISWs.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We would like to compliment Grassland GSA for distinguishing themselves as a GSA comprised of environmental stakeholders. While the GSP sufficiently addressed environmental beneficial users, there were portions of our feedback on the draft GSP that were based on best available science that were not incorporated in the final plan. TNC suggests that Grassland GSA consider our recommendations as areas for improvement in the 2025 version of the GSP. To ensure the plan is well implemented, we hope the GSA will continue to engage stakeholders to prioritize and develop management actions, as well as make plan improvements as data becomes available.

Interconnected Surface Waters – The GSP incorrectly omitted potential and/or actual ISWs because the plan did not employ the best available science. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). ISWs were described to be limited to a 9-mile-long reach of the San Joaquin River on the north edge of the San Luis National Wildlife Refuge because this is the only location where groundwater is "known to be in direct hydraulic communication with a stream." However, depth to groundwater data discussed in Sections 3.2.2.1 and 3.2.2.2 suggests that many of the managed wetlands and other surface water bodies in the Grassland Plan Area are also likely to be groundwater-connected. In addition, no data was provided proving that San Luis Creek, Los Banos Creek, Mud Slough, Salt Slough, Garzas Creek or Ortigalita Creek are not connected to the upper aquifer along some portion of the drainage for some time period. Any areas where a lack of shallow groundwater data makes the determination of ISWs uncertain should be identified as a data gap rather than being assumed to be disconnected. Our analysis of groundwater levels from 2011 to 2018 indicate that all of the streams in the GSP are connecting, including Salt Slough, Los Banos Creek, and other streams and rivers (see Attachment F). Therefore, potential may ISWs exist in the Plan Area that are not being addressed and managed in the GSP.

<u>Map and Assessment of potential ISWs</u>:
By combining multiple years and seasons of groundwater depth data, The Nature Conservancy has determined that within the Grassland GSP, 117.5 river miles are gaining, 49 are losing, and no streams are likely disconnected. Attachment F contains a one-page method summary and a GSP-specific map of ISWs. The interconnected surface water displayed on the map is based on the minimum groundwater depth estimated by the California Department of Water Resources between 2011 and 2018.

Note: In most cases, the groundwater depth data used to generate the ISW map does not include perched aquifers. As such, some streams marked as disconnected could in actuality, be connected.

<u>TNC recommendation:</u> Until a disconnection can be proven, TNC recommends that the GSP include all potential and confirmed ISWs. To help confirm interconnectivity, we suggest prioritizing obtaining additional shallow groundwater level data from the shallow monitoring wells installed by the GGSA in 2018 (and possibly installing additional shallow wells and stream gauges), and performing a thorough review of existing information on surface water-groundwater interconnectivity, including developing estimates of the quantity and timing of streamflow depletions in the Subbasin. Where data gaps exist, we recommend that the GSP describe

concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystems – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 20,079 acres of potential GDEs occur in the GSA boundary. TNC developed the *Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs*[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

We applaud the thoughtful characterization of Wetland GDEs and Vegetative GDEs in the GSA area, including the use of DWR's NC Dataset Viewer to develop GDE maps and use of a Ducks Unlimited wetland delineation dataset to further refine the maps. The GSP provides additional description of the types and extent of managed and natural wetlands, upland GDE and acreages of different types of GDEs. TNC appreciates GGSA's efforts to fully characterize and describe impacts to GDEs and to recognize the role of groundwater in the preservation of habitat and ecosystems in the largest remaining wetland in the United States.

Water Budget – We commend the Grassland Water District (GWD) and Grassland Resource Conservation District (GRCD) for having successfully managed the water budget of the area (including the groundwater budget) for several decades without undesirable results. The GSP used an analytical accounting tool to evaluate the water budget rather than a groundwater model due to a lack of available cropping and water use data in some parts of the Grassland Plan Area. Although the water budget in the GSP includes evapotranspiration (ET) as a surface water outflow, the fact that surface water outflows are greater than inflows likely due to the consumptive use of groundwater by GDEs is not described or accounted for in the model.

<u>TNC recommendation</u>: TNC recommends revisiting ET estimates in the water budget to fully account for all environmental uses of groundwater and to include the groundwater demands of native and wetland vegetation.

Sustainable Management Criteria – The GSP took steps towards including environmental beneficial users of groundwater and interconnected surface water by defining significant and unreasonable undesirable results as a reduction in habitat productivity for declines in groundwater levels. Improvement could be made to the minimum thresholds by describing how a decline in groundwater level will affect GDEs and ISWs.

<u>TNC recommendation</u>: Where, as in Grasslands, the GSP values the preservation of habitats and species that depend on groundwater and interconnected surface waters (e.g., managed wetlands, unmanaged wetlands, instream habitat, terrestrial ecosystems (phreatophytes), migratory birds, and threatened or endangered species), TNC recommends setting Sustainable Management Criteria to protect those species and ecosystems. This could be accomplished by assessing vegetation stress or some other biological metric that can monitor whether impacts are occurring to environmental beneficial users due to groundwater conditions in the basin. Please see our detailed feedback in Attachment B.

The Monitoring Network – The monitoring network could be improved to better characterize the interaction of GDEs and other environmental beneficial users of surface water and groundwater.

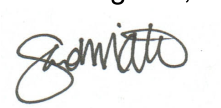
[1] Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

Potential GDEs are located along surface water bodies where no shallow groundwater monitoring is proposed, leaving recognized data gaps unfilled.

<u>TNC recommendation:</u> TNC recommends that the GSP identify and prioritize how to reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to verify possible GDEs as groundwater dependent and reaches of ISWs. The monitoring network could also be improved by exploring how monitoring data could be used to estimate the quantity and timing of streamflow depletions.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but *sustainable* groundwater management that considers the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,



Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

<table>
<tr><th colspan="2">GSP Plan Element*</th><th>GDE Inclusion in GSPs: Identification and Consideration Elements</th><th>Check Box</th></tr>
<tr><td>Admin Info</td><td>2.1.5
Notice & Communication
23 CCR §354.10</td><td>Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.</td><td>1</td></tr>
<tr><td rowspan="3">Planning Framework</td><td rowspan="3">2.1.2 to 2.1.4
Description of Plan Area
23 CCR §354.8</td><td>Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.</td><td>2</td></tr>
<tr><td>Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.</td><td>3</td></tr>
<tr><td>Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs</td><td>4</td></tr>
<tr><td rowspan="7">Basin Setting</td><td rowspan="3">2.2.1
Hydrogeologic Conceptual Model
23 CCR §354.14</td><td>Basin Bottom Boundary:
Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?</td><td>5</td></tr>
<tr><td>Principal aquifers and aquitards:
Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?</td><td>6</td></tr>
<tr><td>Basin cross sections:
Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?</td><td>7</td></tr>
<tr><td rowspan="4">2.2.2
Current & Historical Groundwater Conditions
23 CCR §354.16</td><td>Interconnected surface waters:</td><td>8</td></tr>
<tr><td>Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).</td><td>9</td></tr>
<tr><td>Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.</td><td>10</td></tr>
<tr><td>Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).</td><td>11</td></tr>
</table>

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Grassland Groundwater Sustainability Plan

The Grassland Groundwater Sustainability Plan (GSP), adopted December 10, 2019 as Resolution 2019-119, was reviewed by TNC. TNC submitted comments on the Public Draft GSP on November 27, 2019. Responses to comments on the public draft were not publicly available so we compared the Public Draft GSP to the Final GSP to determine whether changes were made to the Final GSP in response to TNC's comments. This attachment lists our original comments on Public Draft GSP, as submitted to the Grassland Groundwater Sustainability Agency (GSA) during the public comment period, and states [in green text in brackets] whether or not our comments were addressed in the Final GSP.

<u>Checklist Item 1 – Notice & Communication (23 CCR §354.10)</u>

[Section 2.6.1 Description of Beneficial Uses and Users (p. 2-44)]

- *[We applaud the inclusion of the information listed in our comment in the draft GSP. TNC's recommendation for further improvement (i.e., inclusion of a description of the types and extent of managed and natural wetlands and upland GDE areas in the Plan Area) was provided in Section 2.5.12 of the draft GSP.]* We applaud the inclusion of 1) environmental users of groundwater, specifically public wildlife refuges and private wetlands, in the description of beneficial uses and users of groundwater in Section 2.6.1 of the GSP; 2) a list of potential freshwater species in Table CC-7 of the Delta-Mendota Groundwater Subbasin GSP: Common Chapter (Appendix A); and a description of the types and extent of managed vs. natural wetland and upland GDE areas. Environmental stakeholders were engaged throughout the development of the GSP as described in this and other sections. The Board of Directors of the Grassland Water District (GWD) and Grassland Resource Conservation District (GRCD) consulted with California Department of Fish and Wildlife (CDFW) and United States Fish and Wildlife Service (USFWS). GWD, CDFW and USFWS hold the surface water rights used within the Grassland Plan Area. **The GSP could be further improved by including an additional description of the types and extent of managed and natural wetlands and upland GDE areas in the Plan Area.**

<u>Checklist Items 2 to 4 - Description of Plan Area (23 CCR §354.8)</u>

[Section 2.1 Plan Area, 2.2 Summary of Jurisdictional Areas, 2.3 Water Resources Monitoring and Management Programs, 2.4 Relation to General Plans (pp. 2-1 to 2-32)]

- *[We appreciate the inclusion of the information listed in our comment in the draft GSP. TNC's recommendation for further improvement (i.e., additional descriptions of how the plan relates to the requirements of other resource management plans of federal, state and local agencies that are applicable to wetlands, other GDEs and*

threatened or endangered species that may use these habitats) was provided in Section 2.2.1 of the draft GSP.] Section 2.1.2 (p. 2-4) of the GSP provides a robust description of the Grassland Ecological Area (GEA), which is recognized as a critical wetland ecosystem and consists of a combination of privately managed wetland habitat, state wildlife areas, and national wildlife refuges that provide habitat for migratory birds. A description of
    - existing land use (p. 2-7),
    - water sources and use (p. 2-9),
    - jurisdictional areas (p. 2-11),
    - existing water resource monitoring and management programs (p. 2-19), and
    - land use elements of general plans are provided (p. 2-27).

  The GSP could be further improved by including additional descriptions of how the plan may relate to the requirements of other resource management plans of federal, state and local agencies that are applicable to wetlands, other GDEs and threatened or endangered species that may use these habitats.
- *[TNC comments not incorporated.]* Section 2.4.4 (Permitting New or Replacement Wells) (p. 2-31) of the GSP describes the well permitting program adopted under Chapters 9.27 and 9.28 of the Merced County Code and managed by Merced County Department of Public Health, Division of Environmental Health (MCDEH). Although this section describes the county Groundwater Mining and Export Ordinance (Chapter 9.27) and recognizes that mining and export of groundwater may yield adverse physical impacts to beneficial users of groundwater, the plan would benefit from further description of this important groundwater management program. This Ordinance is closely aligned with the sustainability goals of this GSP, and prohibits the "mining" of groundwater (regardless of whether it is exported from the county), which is defined as *"… the process, deliberate or inadvertent, of extracting groundwater from a source at a rate or amount in excess of the replenishment rate, such that the groundwater level declines persistently, threatening exhaustion of the supply, a decline of pumping levels to uneconomic depths, land subsidence, or significant water quality or other significant environmental damage*." The Ordinance requires an applicant to provide information that issuing a permit would not violate this prohibition, and because issuing such permits is discretionary, requires review under the California Environmental Quality Act (CEQA) before a permit can be issued. **Please consider including a description of the implications of the Groundwater Ordinance regarding sustainable management of new well permits under each of the applicable SGMA sustainability indicators. In addition, we suggest adding a discussion of how future well permitting and well construction will be coordinated with the GSP under SGMA to assure achievement of sustainability goals.** The State Third Appellate District recently found that counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF v. SWRCB and Siskiyou County, No. C083239). **We recommend including a discussion of the need for the well permitting program to comply with this requirement.**

Checklist Items 5 to 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 3.1 Hydrogeologic Conceptual Model, 3.2 Groundwater Conditions (p. 3-1 to 3-40)]

- *[TNC comments not incorporated.]* The Hydrogeologic Conceptual Model thoroughly describes the principal upper and lower aquifers. Basin-wide cross sections provided in Figures 3-10 through 3-14 include a graphical representation of the lateral and vertical distribution of the aquifers and the Corcoran Clay aquitard that separates them. However, very little information is provided regarding how the upper aquifer may be connected to and interact with surface water and GDEs, and whether perched aquifers exist. Although direct groundwater interaction is not the primary source of water to most of the wetlands in the Plan Area, it is nevertheless an important consideration in terms of understanding how groundwater management could be optimized to support both the sustainability goals of the GSP and the mission of the GWD and GRCD to provide wetland habitat. **We suggest the GSP could be improved by providing additional descriptions of perched aquifers, interconnections between shallow groundwater and surface water and GDEs, vertical groundwater gradients, connections with the lower aquifer through the Corcoran Clay, and the resulting potential interaction of groundwater pumping with ISWs and GDEs.**
- *[TNC comments not incorporated.]* Section 3.2.2.1 (Depth to Water) (p. 3-22). The depth to groundwater in the shallow monitoring wells installed by the GGSA in 2018 ranged from 1 to 5 feet in the spring and 4 to 9 feet in the fall. Inference is made that groundwater levels in the upper aquifer are shallow enough to be directly evaporated. As such, much of the vegetation in areas of shallow groundwater in the Plan Area likely rely on shallow groundwater to meet at least a portion of its evapotranspiration demand and thus meets the definition of a GDE. Information is provided regarding the Level 4 Groundwater Development Project; a groundwater exchange program whereby private pumpers are contracted to deliver up to 29,000 AFY pumped from their wells for use in managed wetlands. In exchange, the contracted pumpers are provided surface water, to which GWD holds water rights, that can be used for irrigation. Groundwater levels in upper aquifer wells enrolled in this program that were measured in 2014 ranged from 10 to 20 feet below ground surface. The effects of this substantial program on groundwater levels, and the resulting impacts on GDEs, ISWs and the water budgets of managed wetlands should be identified. **The GSP could be improved by further describing the implication of shallow groundwater levels identified in the recently installed monitoring wells relative to GDEs and ISWs. A discussion of the effects of the Level 4 Groundwater Development Project on shallow groundwater levels, GDEs, ISWs and the water budgets of managed wetlands could also be provided.**
- *[TNC comments not incorporated.]* Section 3.2.2.2 (Water Level Elevations and Direction of Flow) (p. 3-23). Figure 3-15 shows Spring 2015 groundwater elevations as ranging from 130 feet amsl in the southwest to 70 feet amsl in the north. Groundwater flow is generally northward and converges on an apparent discharge area that extends northward along the center of the Plan Area; however, this flow field and the discharge implications of converging flow lines are not discussed. In

addition, it is unclear how these groundwater elevations relate to depths to groundwater for the shallow monitoring wells discussed in Section 3.2.2.1. **Please consider providing an explanation of current groundwater flow directions and converging flow lines along the center of the Plan Area and explain how the reported upper aquifer groundwater elevations relate to groundwater elevations measured in recently installed shallow monitoring wells. It would be helpful to discuss the implications of this information on the interaction between groundwater extraction from the upper aquifer and GDEs, ISWs and the water budgets of managed wetlands.**

- *[TNC comments not incorporated.]* Section 3.2.3 (Potential Sources of Groundwater Recharge) (p. 3-30) identifies the primary sources of recharge as groundwater inflow, seepage from water conveyance facilities, and deep percolation from wetlands. We agree that managed wetlands are a significant source of recharge in the Grassland Plan Area; however, the converging groundwater flow lines in the upper aquifer near the center of the Plan Area suggest this is an area of net groundwater discharge. **Please consider 1) elaborating on the potential relationship between recharge and discharge from the managed wetland areas, 2) providing evidence for spatial and temporal variability in recharge, 3) providing implications for shallow groundwater levels that could support GDEs and management of the wetlands, and 4) identifying any data gaps and plans to address them in the monitoring networks.**
- *[TNC comments not incorporated.]* Section 3.2.4 (Potential Sources of Groundwater Discharge) (p. 3-32) identifies the primary sources of upper aquifer discharge as pumping, groundwater outflow toward the San Joaquin River, downward percolation through the Corcoran Clay, and evaporation and evapotranspiration of shallow groundwater. No further explanation is provided. **Please identify and describe GDEs, ISWs and evapotranspiration from managed wetlands as discharge components and beneficial users.**

<u>Checklist Items 8, 9 and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)</u>

[Section 3.2.9 Interconnected Surface and Groundwater Systems (p. 3-39)]

- *[TNC comments not incorporated.]* The regulations [23 CCR §351(o)] define ISWs as "*surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted*." "*At any point*" has both a spatial and temporal component. Even short durations of interconnection between groundwater and surface water can be crucial for surface water flow and support of environmental users and uses of groundwater and surface water. ISWs can be streams, lakes, wetlands (including managed wetlands) and other surface water bodies. ISWs can be either gaining or losing. The GSP (p. 3-39) states that "*(t)he only locations in the area evaluated where groundwater is known to be in direct hydraulic communication with a stream is along a nine-mile-long reach of the San Joaquin River on the north edge of the San Luis NWR."* Groundwater contour maps from shallow monitoring wells installed nearby indicate that the river is gaining along this reach. Depth to groundwater data discussed in Sections 3.2.2.1 and 3.2.2.2 suggests that many of the managed wetlands and other surface water bodies in the Grassland Plan Area are also likely to be groundwater-connected. No data is provided in the GSP to show that San Luis Creek, Los Banos Creek, Mud Slough, Salt Slough, Garzas Creek or Ortigalita Creek are not connected to the upper aquifer along some portion of the drainage for some time period. **We suggest providing additional data or analysis to substantiate the nature of the hydrologic relationship between the upper aquifer and these additional ISWs, including the San Joaquin River, other creeks within the Plan Area, managed wetlands, and other surface water bodies. Any areas where a lack of shallow groundwater data makes the determination of ISWs uncertain should be identified as a data gap. Data used to fill the data gap could include groundwater level data from shallow or nested monitoring wells, comparison of stream stages or water surface elevation data to groundwater levels, modeling information or additional gaging data.**

Checklist Items 11 to 20 – Identifying, Mapping and Describing GDEs (23 CCR §354.16)

[Section 2.5.12 Impacts to Groundwater-Dependent Ecosystems (p. 2-40)]

- *[We applaud the Grassland GSA for identifying and mapping GDEs in this important ecosystem and recognizing the role of groundwater in habitat preservation.]* Section 2.5.12 and other sections throughout the GSP more than adequately identify, map, and describe GDEs within the Grassland Plan Area. The GSP relied on a Ducks Unlimited (DU) wetland delineation dataset to develop a Wetland GDE map (Figure 2-10) and used TNC's Natural Communities Commonly Associated with Groundwater (NCCAG) database to evaluate Vegetative GDEs (Figure 2-11). As described, many of the possible GDEs identified and mapped occur within habitat managed by GWD, GRCD, and state and federal entities within the Plan Area. The vegetative GDE map considers that all vegetation polygons identified in the NC Dataset are possible GDEs. As such, the GGSA's GSP is a model GSP that fully recognizes the role of groundwater in the preservation of habitat and ecosystems in the largest remaining wetland in the United States.
- *[No changes to GSP text made.]* Data gaps have been identified in Section 5.5.2 (p. 5-30) related to the existing monitoring network for the depletion of ISW sustainable management criterion. Limited shallow groundwater level monitoring data are available along the San Joaquin River within the Grassland Plan Area. The extensive surface water monitoring network in the managed wetlands provides a unique opportunity to better understand the interaction between groundwater pumping, shallow groundwater, surface water, and wetland vegetation. **Please consider installing additional shallow monitoring wells in the future to augment the monitoring network in this area.**

Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)

[Section 3.3 Water Budget (pp. 3-41 to 3-66)]

- *[We would like to highlight the fact that GWD and GRCD have successfully managed the water budget of the area (including the groundwater budget) for several decades* *without undesirable results. TNC recommendations were not incorporated.]* Section 3.3.1 (p. 3-41) states that an analytical accounting tool was used to evaluate the water budget rather than a groundwater model. A lack of available cropping and water use data in some parts of the Grassland Plan Area during the historical average period selected for the GSP is cited as a primary reason for this decision. While the GSP correctly states that GSP regulations do not require the use of a model if an equally effective tool can be implemented, the GSP would significantly benefit from a more robust demonstration that the analytical accounting tool is equally effective. **Please consider data to validate or calibrate the assumptions incorporated into the water budget accounting tool. A more thorough description of the tool, its development and historical use would also greatly improve this discussion. Finally, it would be helpful to note the fact that GWD and GRCD have successfully managed the water budget of the area (including the groundwater budget) for several decades without undesirable results. We believe that incorporation of these details would make the use of an analytical water budget accounting tool more likely to be accepted.**

- *[TNC comments not incorporated.]* ET is included as a surface water system outflow (p. 3-50). Surface water system outflows are reported to be greater than inflows, which is likely due to the consumptive use of groundwater by GDEs (p. 3-61). This is consistent with information in earlier sections of the GSP and our comments above that the Grassland Plan Area is characterized by extensive GDEs and ISWs. We note, however, that the ET surplus in the surface water budget is greater than the ET discharge in the groundwater budget (by up to 280% in the current water budget). **Please consider providing additional explanation of the accuracy and uncertainty of the ET estimates and identify data gaps as appropriate.**

<u>Checklist Items 23 to 25 – Sustainability Goal (23 CCR §354.24)</u>

[Section 4.1 Sustainability Goal (p. 4-1)]

- *[No changes to GSP text made. While the sustainability goal is written in a general way to encompass all of the GSAs within the Delta-Mendota Subbasin, we note that GGSA mentions environmental uses and users of groundwater in subsequent paragraphs within Section 4.1 (p. 4-2). In addition, the last sentence of Section 4.1 should include a reference to ISWs.]* The sustainability goal for the Delta-Mendota Subbasin reiterates regulatory requirements and does not provide a clear description of the goal relative to the Grassland Plan Area setting and beneficial uses. Beneficial uses and users of groundwater in the Plan Area are predominantly environmental, as is noted throughout the GSP, yet the goal does not specifically mention environmental uses or users of groundwater. **The GSP would benefit from better capturing the fact that the sustainability goal for the Plan Area includes ensuring that all beneficial uses and users of groundwater, including GDEs, ISWs and related critical habitats, migratory birds, and threatened or endangered species, are protected from undesirable results.**

Checklist Items 30 to 46 – Undesirable Results (23 CCR §354.26)

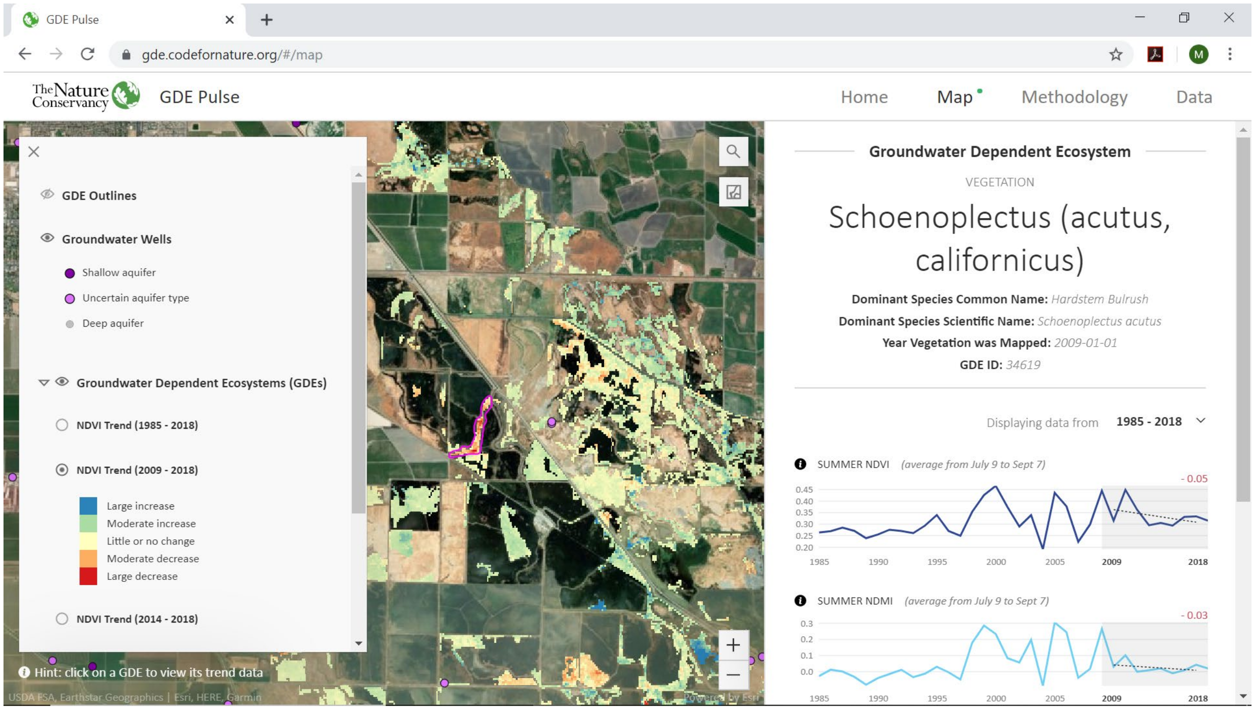
[Section 4.3.1 Undesirable Result Development (pp. 4-3 to 4-5)]

- *[TNC comments not incorporated.]* Interconnected Surface Water. The GSP states that *"(g)roundwater pumping in the Grassland Plan Area does not influence surface water depletion"* (p. 4-5) and that "*no management activities have depleted interconnected surface water in the Grassland Plan Area within the historical period*." This is presumably because groundwater pumping to maintain water levels in managed wetlands will always result in a net contribution to the wetland, even if some of the water is recaptured by the well through increased seepage, and additional surface water may be provided when available to maintain habitat productivity. In addition, the maintenance of water levels in the managed wetlands and the proximity of the San Joaquin River will help to mitigate potential effects to unmanaged wetlands, upland GDEs (e.g., alkaline meadows), or streams by maintaining high groundwater levels. **We suggest revising the discussion to further explain why significant and unreasonable impacts to GDEs and ISWs are not likely to occur.**

Checklist Items 27 to 29 - Minimum Thresholds (23 CCR §354.28)

[Section 4.3.3 Significant and Unreasonable Impacts & Threshold Exceedances Defining Undesirable Results (pp. 4-6 to 4-12)]

- *[TNC comments not incorporated.]* Minimum Thresholds for Groundwater Levels and Groundwater Storage (p. 4-7 and Table 4-1). A 20% lowering of groundwater levels below recent historical low groundwater levels during the period 2000-2019 defines an undesirable result based on impacts to environmental beneficial uses. Management actions are triggered by three years of threshold exceedance or when more than 50% of monitoring sites exceed the threshold. **The GSP would benefit from a more robust explanation of the process and rationale for selection of this threshold, and why it is considered protective of GDEs and ISWs, including managed wetlands, unmanaged wetlands, upland GDEs and ISWs. Please also consider providing additional data to substantiate this threshold, such as an assessment of vegetation stress in response to the historical low groundwater levels using TNC's GDE Pulse tool** (refer to https://gde.codefornature.org). Below is a screenshot example of data available in GDE Pulse for NC Dataset polygons found in the Subbasin.



- *[TNC comments not incorporated.]* Minimum Thresholds for Interconnected Surface Waters (p. 4-8 and Table 4-2). Significant and unreasonable undesirable results for ISWs are defined as a reduction of interconnected surface waterbodies and associated GDEs that would require a reduction in groundwater pumping. Reduction in groundwater discharge to the San Joaquin River would indicate an undesirable result since it would signal that near-surface groundwater levels are no longer being maintained, and undesirable results would adversely affect the riparian corridors along the San Joaquin River and "*groundwater dependent plant communities*" throughout the Plan Area. The threshold is set as a 20% groundwater level decline below recent historical low levels during the period 2000-2019 in 50% or more upper aquifer monitoring wells. **The GSP would benefit from a similar discussion for this sustainability indicator to that suggested above for groundwater level decline.**

[Section 4.4 Minimum Thresholds (pp. 4-14 to 4-24)]

- *[TNC comments not incorporated.]* The rationale described in Section 4.3.3 is repeated in this section and thresholds are developed for specific wells. Minimum thresholds for groundwater levels, groundwater storage (using groundwater levels as a proxy), and ISWs were developed considering the upper aquifer as the principal source aquifer for the Grassland Plan Area. Discussion regarding GDEs and ISWs is minimal, and none of the minimum thresholds directly address measurement of effects on environmental beneficial users such as ISWs or GDEs. **Since ISWs and GDEs are covered by this GSP, we recommend that for each of the applicable sustainable management criteria, the GSP includes a discussion of GDEs and ISWs and how the minimum threshold will affect them.**

Checklist Item 26 – Measurable Objectives (23 CCR §354.30)

[Section 4.5 Measurable Objectives (pp. 4-25 to 4-30)]

- *[TNC comments not incorporated.]* Section 4.5.1 (Groundwater Levels, Groundwater Storage & Interconnected Surface Water) (p. 4-25 to 4-27). Measurable objectives for chronic lowering of groundwater levels, reduction of groundwater storage and depletion of ISWs are set using groundwater levels as a proxy at the historical low groundwater levels measured between 2000 and 2019. **The GSP would benefit from a similar discussion of Minimum Thresholds and the rationale for selection of Measurable Objectives and their intended effect on GDEs and ISWs.**

Checklist Items 47-49 – Monitoring Network (23 CCR §354.34)

[Section 5.1.3 Description of Monitoring Network (pp. 5-7 to 5-22)]

- *[TNC comments not incorporated.]* The GSP proposes to use groundwater level monitoring for tracking chronic groundwater level decline, and as a proxy for groundwater storage reduction and depletion of ISWs. A set of representative wells have been selected (p. 5-8) to monitor the upper aquifer (nine wells) and lower aquifer (six wells). The GSP would benefit from the addition (now or in the future) of remote sensing data to assess the potential for significant and unreasonable impacts to GDEs or ISWs, integration of groundwater monitoring with the extensive system of surface water conditions in the area, and the construction of additional shallow monitoring wells. **Please consider adding an expanded description of how the monitoring networks may be refined in the future using these components.**
- *[TNC comments not incorporated.]* As described in Section 5.1.3.6 (p. 5-20), the analysis of impacts on ISWs will be evaluated by assessing groundwater levels across the Plan Area in the representative water level monitoring network. Flow conditions, periods of flow, variations, and other factors in the San Joaquin River reach adjacent to the Grassland Plan Area will be further evaluated using supplemental data from San Joaquin River Restoration Program shallow monitoring wells, contract surface water delivery flows from GWD, and information from MCDMGSA state and federal refuges. **It would be helpful to expand on the discussion of how new well and flow data will be used to improve ISW mapping and verify possible GDEs and ISWs.**

Checklist Items 50 and 51 – Projects and Management Actions (23 CCR §354.44)

[Section 6 Projects and Management Actions to Achieve Sustainability (pp. 6-1 to 6-8)]

- *[TNC comments not incorporated.]* As demonstrated in Section 3 of the GSP, the Grassland Plan Area is currently sustainable and not experiencing any undesirable results. The GSP describes projects currently being implemented by the GGSA to maintain sustainability and facilitate regional projects for the good of the Plan Area, agencies within the Delta-Mendota Subbasin, and other basins. The projects identify benefits to groundwater levels, groundwater storage, water quality, water supply, wetland habitats and GDEs. **Emphasizing the multiple benefits of these project may increase the likelihood of grant funding for their future implementation.**

Attachment C

Freshwater Species Located in the Delta-Mendota Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Delta-Mendota Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[2]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[3] as well as on TNC's science website[4].

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			

[2] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[3] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[4] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Aythya valisineria	Canvasback		SSC	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		SSC	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	BCC	SSC	BSSC - Third priority
Dendrocygna bicolor	Fulvous Whistling-Duck		SSC	BSSC - First priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	BCC	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	BCC	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		SSC	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		SSC	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		SSC	BSSC - Third priority
CRUSTACEANS				
Artemia franciscana	San Francisco Brine Shrimp			
Branchinecta conservatio	Conservancy Fairy Shrimp	Endangered	SSC	IUCN - Endangered
Branchinecta lindahli	Versatile Fairy Shrimp			

Scientific Name	Common Name	Legally Protected Species		
		Federal	**State**	**Other**
Branchinecta longiantenna	Longhorn Fairy Shrimp	Endangered	SSC	IUCN - Endangered
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	SSC	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	SSC	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		SSC	IUCN - Near Threatened
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		SSC	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Pseudacris regilla	Northern Pacific Chorus Frog			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	SSC	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	SSC	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	SSC	ARSSC
Thamnophis atratus atratus	Santa Cruz Gartersnake			Not on any status lists
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis hammondii hammondii	Two-striped Gartersnake		SSC	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS AND OTHERS				
Aeshnidae fam.	Aeshnidae fam.			
Anax junius	Common Green Darner			
Brillia spp.	Brillia spp.			
Callicorixa spp.	Callicorixa spp.			
Capnia hitchcocki	Arroyo Snowfly			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Chironomus spp.	Chironomus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corisella spp.	Corisella spp.			
Cricotopus spp.	Cricotopus spp.			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Mesocapnia bulbosa	Bulbous Snowfly			
Paraleptophlebia associata	A Mayfly			
Paratanytarsus spp.	Paratanytarsus spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Procladius spp.	Procladius spp.			
Psectrocladius spp.	Psectrocladius spp.			
Tanypus spp.	Tanypus spp.			
Tipulidae fam.	Tipulidae fam.			
Trichocorixa spp.	Trichocorixa spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		SSC	
Margaritifera falcata	Western Pearlshell		SSC	
Pyrgulopsis diablensis	Diablo Range Pyrg		SSC	E
PLANTS				
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla filiculoides	NA			
Azolla microphylla	Mexican mosquito fern		SSC	CRPR - 4.3

Scientific Name	Common Name	Legally Protected Species		
		Federal	**State**	**Other**
Baccharis salicina				Not on any status lists
Bacopa eisenii	Gila River Water-hyssop			
Bidens laevis	Smooth Bur-marigold			
Bolboschoenus glaucus	NA			Not on any status lists
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Callitriche marginata	Winged Water-starwort			
Ceratophyllum demersum	Common Hornwort			
Chloropyron molle hispidum			SSC	CRPR - 1B.1
Chloropyron palmatum	NA	Endangered	SSC	CRPR - 1B.1
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Crypsis vaginiflora	NA			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus squarrosus	Awned Cyperus			
Downingia bella	Hoover's Downingia			
Downingia pulchella	Flat-face Downingia			
Echinodorus berteroi	Upright Burhead			
Elatine brachysperma	Shortseed Waterwort			
Elatine californica	California Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis atropurpurea	Purple Spikerush			
Eleocharis coloradoensis				Not on any status lists
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Eleocharis quadrangulata	NA			
Elodea canadensis	Broad Waterweed			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eragrostis hypnoides	Teal Lovegrass			
Eryngium castrense	Great Valley Eryngo			
Eryngium racemosum	Delta Coyote-thistle		Endangered	CRPR - 1B.1
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle		SSC	CRPR - 1B.2
Eryngium vaseyi vallicola				Not on any status lists
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Juncus acuminatus	Sharp-fruit Rush			
Juncus xiphioides	Iris-leaf Rush			
Lasthenia ferrisiae	Ferris' Goldfields		SSC	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Lemna aequinoctialis	Lesser Duckweed			
Lemna gibba	Inflated Duckweed			
Lemna minor	Lesser Duckweed			
Lepidium jaredii jaredii	Jared's Pepper-grass		SSC	CRPR - 1B.2
Lepidium oxycarpum	Sharp-pod Pepper-grass			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limosella acaulis	Southern Mudwort			
Lipocarpha micrantha	Dwarf Bulrush			
Ludwigia peploides peploides	NA			Not on any status lists
Ludwigia repens	Creeping Seedbox			
Lythrum californicum	California Loosestrife			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus cardinalis	Scarlet Monkeyflower			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Mimulus guttatus	Common Large Monkeyflower			
Montia fontana fontana	Fountain Miner's-lettuce			
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Myriophyllum aquaticum	NA			
Najas guadalupensis guadalupensis	Southern Naiad			
Navarretia heterandra	Tehama Navarretia			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Navarretia prostrata	Prostrate Navarretia		SSC	CRPR - 1B.1
Neostapfia colusana	Colusa Grass	Threatened	Endangered	CRPR - 1B.1
Panicum dichotomiflorum	NA			
Paspalum distichum	Joint Paspalum			
Persicaria hydropiperoides				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria pensylvanica	NA			Not on any status lists
Phacelia distans	NA			
Phyla lanceolata	Fog-fruit			
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Pluchea odorata odorata	Scented Conyza			
Pogogyne douglasii	NA			
Pogogyne zizyphoroides				Not on any status lists
Potamogeton diversifolius	Water-thread Pondweed			
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton nodosus	Longleaf Pondweed			
Potamogeton pusillus pusillus	Slender Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Psilocarphus tenellus	NA			
Puccinellia simplex	Little Alkali Grass			
Ranunculus sceleratus	NA			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rorippa palustris palustris	Bog Yellowcress			
Rotala ramosior	Toothcup			
Ruppia cirrhosa	Widgeon-grass			
Ruppia maritima	Ditch-grass			
Sagittaria longiloba	Longbarb Arrowhead			
Sagittaria montevidensis calycina				Not on any status lists
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus americanus	Three-square Bulrush			
Sinapis alba	NA			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Sparganium eurycarpum eurycarpum				
Stuckenia pectinata				Not on any status lists
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica americana	American Speedwell			
Wolffiella lingulata	Tongue Bogmat			
Zannichellia palustris	Horned Pondweed			
FISHES				
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	SSC	Vulnerable - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Pogonichthys macrolepidotus	Sacramento splittail		SSC	Vulnerable - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	SSC	Endangered - Moyle 2013
Acipenser transmontanus	White sturgeon		SSC	Vulnerable - Moyle 2013
Archoplites interruptus	Sacramento perch		SSC	Endangered - Moyle 2013
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Cottus asper ssp. 1	Prickly sculpin			Least Concern - Moyle 2013
Entosphenus tridentata ssp. 1	Pacific lamprey		SSC	Near-Threatened - Moyle 2013
Gasterosteus aculeatus microcephalus	Inland threespine stickleback		SSC	Least Concern - Moyle 2013
Hysterocarpus traskii traskii	Sacramento tule perch		SSC	Near-Threatened - Moyle 2013
Lampetra ayersi	River lamprey		SSC	Near-Threatened - Moyle 2013
Lampetra hubbsi	Kern brook lamprey		SSC	Vulnerable - Moyle 2013

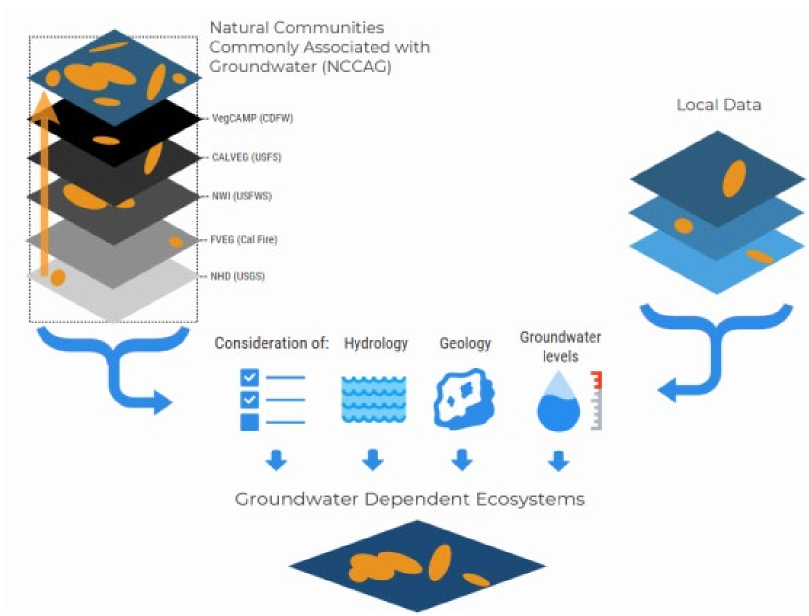
Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Lampetra richardsoni	Western brook lamprey			Near-Threatened - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		SSC	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		SSC	Near-Threatened - Moyle 2013
Mylopharodon conocephalus	Hardhead		SSC	Near-Threatened - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	SSC	Vulnerable - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus tshawytscha - CV fall	Central Valley fall Chinook salmon	SSC	SSC	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV late fall	Central Valley late fall Chinook salmon	SSC		Endangered - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Pogonichthys macrolepidotus	Sacramento splittail		SSC	Vulnerable - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
Notes: ARSSC = At-Risk Species of Special Concern BCC = Bird of Conservation Concern BSSC = Bird Species of Special Concern CRPR = California Rare Plant Rank IUCN = International Union for Conservation of Nature SSC = Species of Special Concern				

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[5] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[6]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[5] *NC Dataset Online Viewer:* https://gis.water.ca.gov/app/NCDatasetViewer/

[6] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[7]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[8] on the Groundwater Resource Hub[9], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[7] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[8] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[9] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

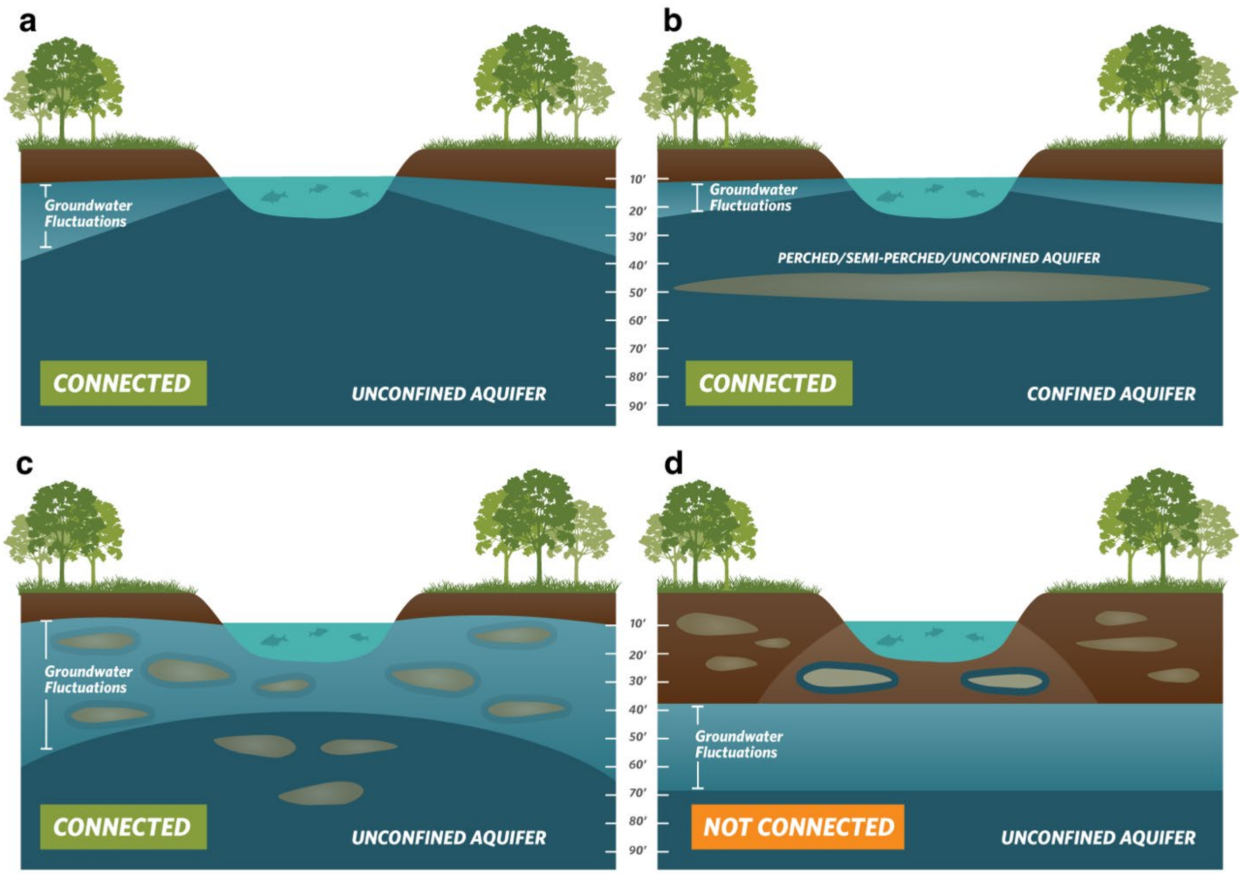

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[10] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[11] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[12] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[13]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

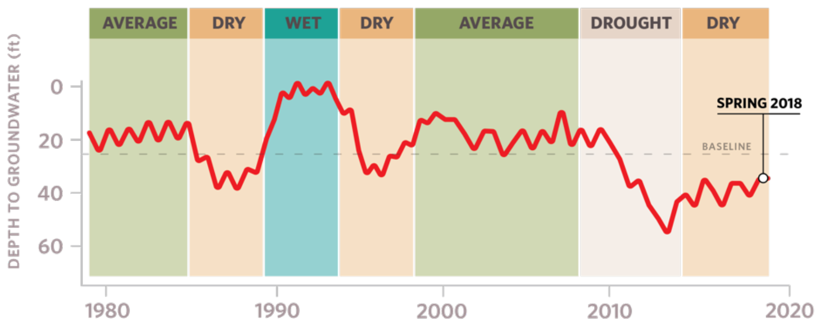

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[10] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[11] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[12] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[13] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[14], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

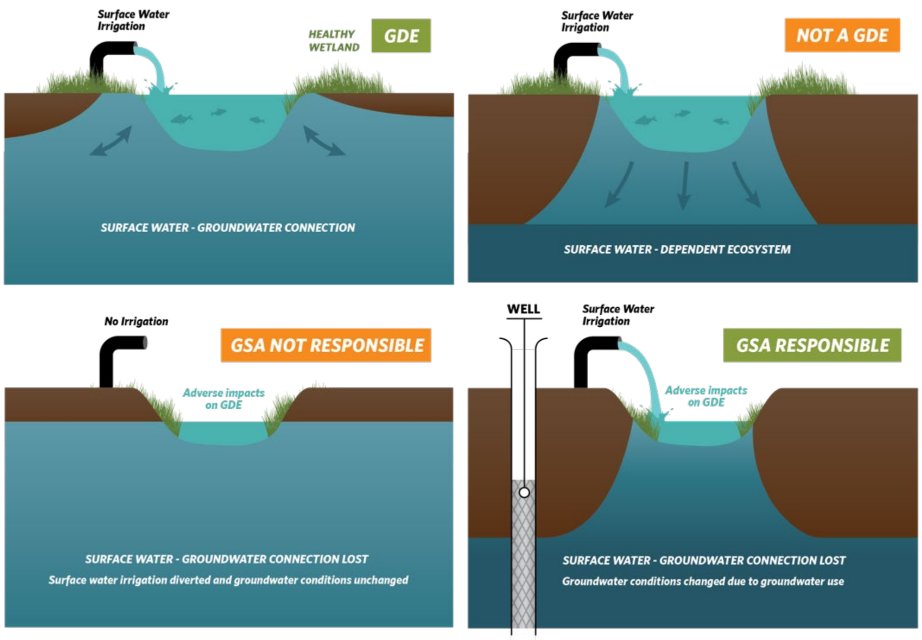

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[14] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

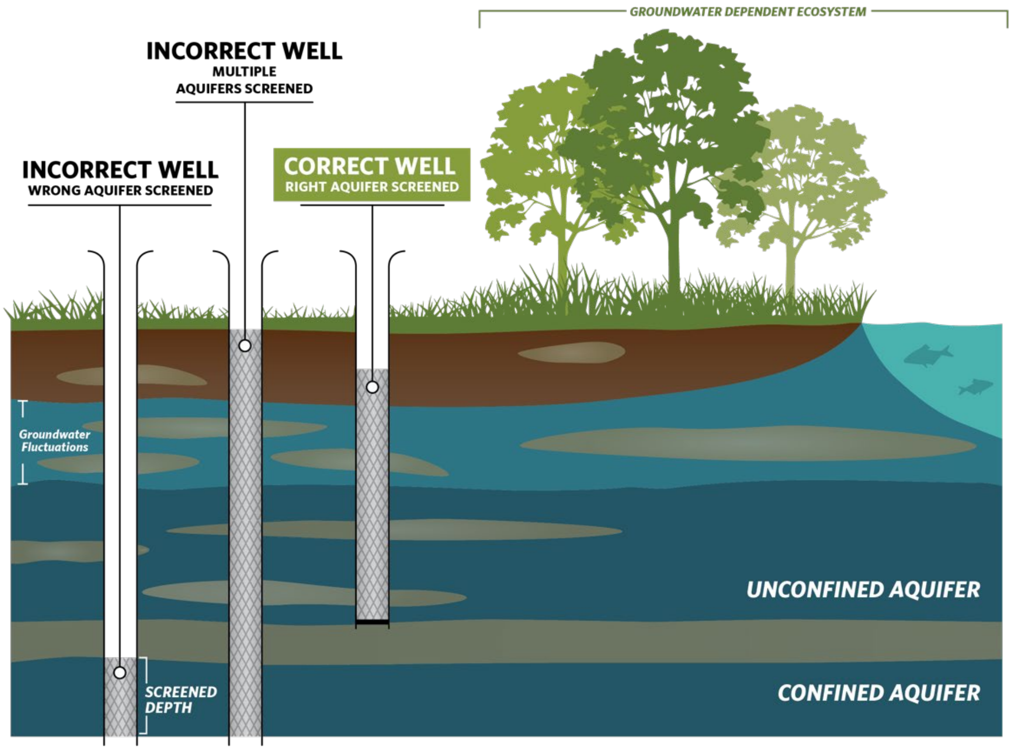

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[15] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

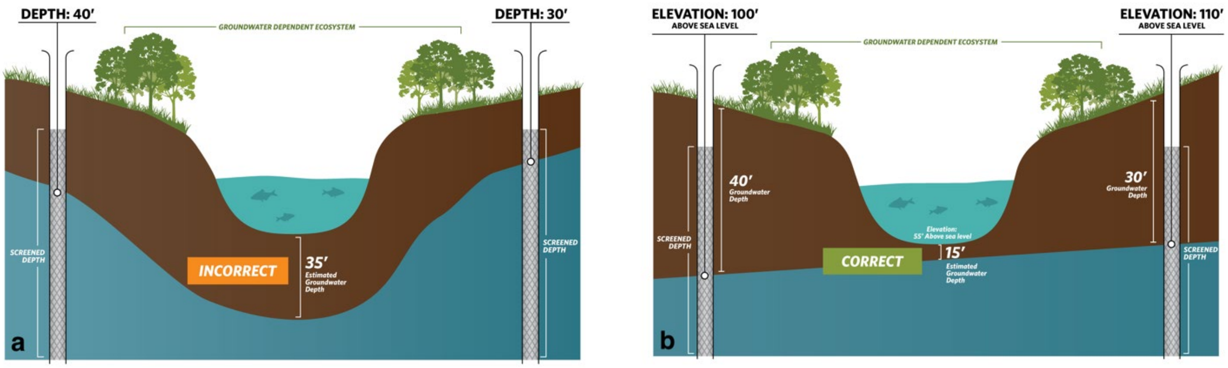

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

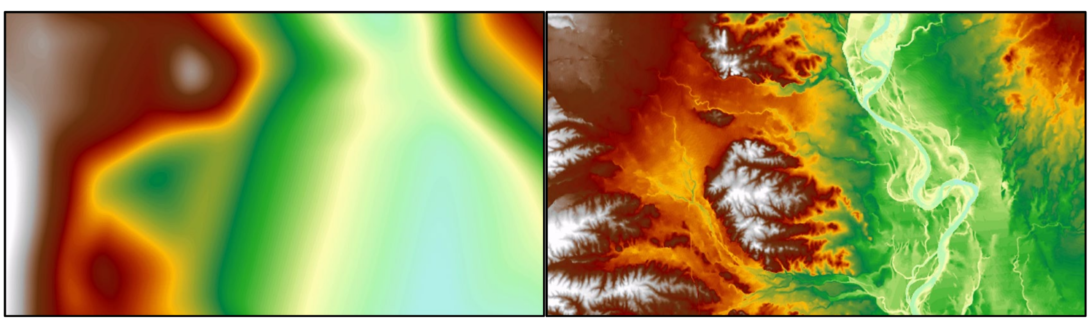

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[15] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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https://gde.codefornature.org/

Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[16]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[17]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

[16] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[17] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F

Mapping Likely Interconnected Surface Water

The Nature Conservancy, California, May 2020

Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, ISW is defined as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:

The groundwater elevation data, available for Spring 2011-2012, and Spring and Fall 2013-2018, comes from the California Department of Water Resources (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). These data are represented as continuous raster layers that approximates "feet above or below mean sea level" based on groundwater well measurements. According to the documentation online, groundwater level measurements were selected based on measurement date and well construction information (where available) and are intended to approximate the groundwater levels in the unconfined to uppermost semi-confined aquifers. Each of the raster layer has a different extent, but all of them are limited to the Central Valley. To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

The map splits groundwater depth into four categories:

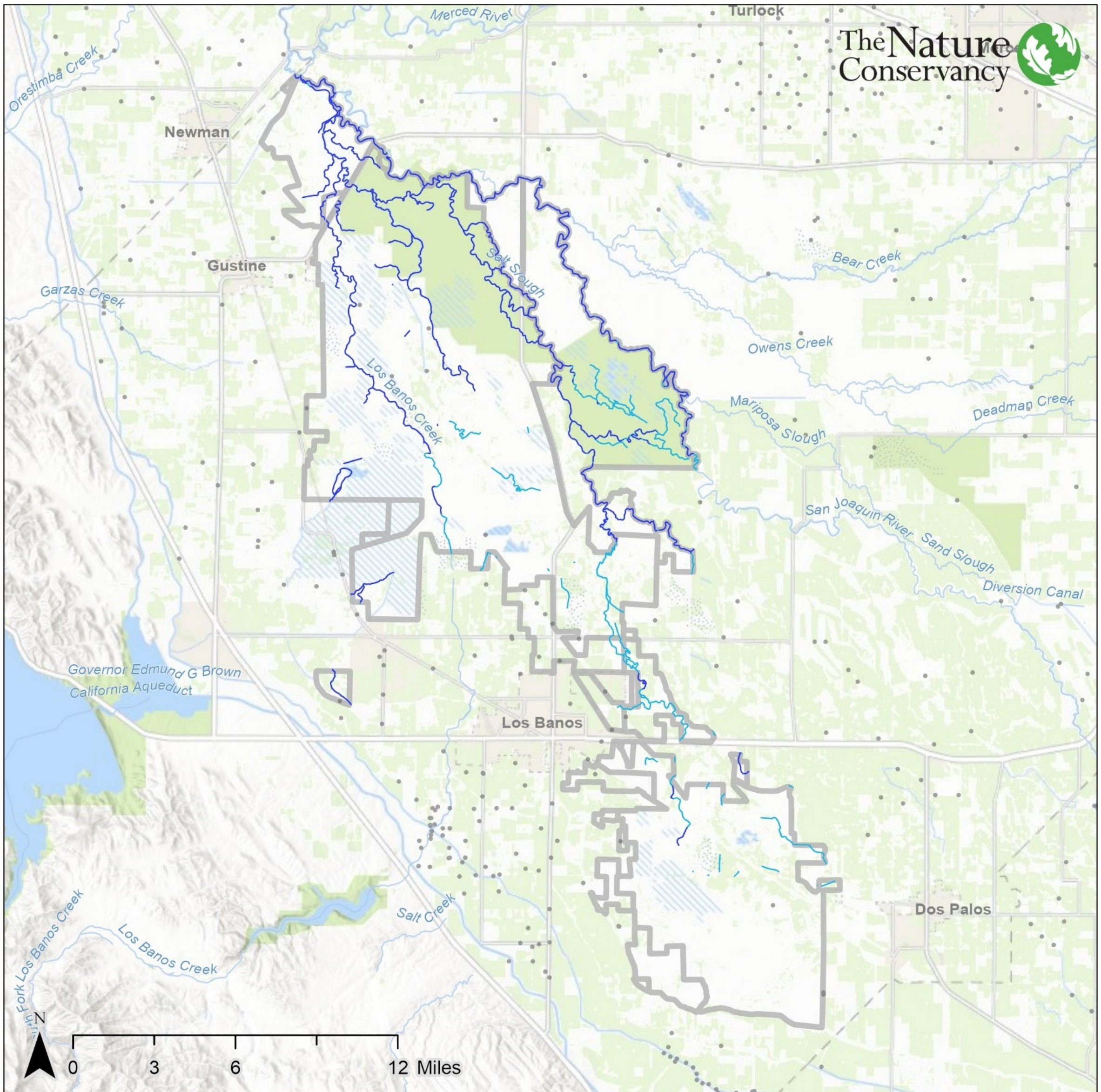
- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.

- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.

Interconnected Surface Water: Minimum Groundwater Depth (2011-2018)

Grassland GSA GSP



Legend

- Groundwater Sustainability Agency (GSA)
- No groundwater depth data available
- Rivers and streams with no depth data (0 miles)
- Groundwater Elevation Monitoring Point

Minimum Groundwater Depth

- Connected - Gaining: Groundwater at or above stream surface (117.5 miles)
- Connected - Losing: Groundwater within 20 feet of stream surface (49 miles)
- Uncertain*: Groundwater within 20-50 feet of stream surface (0 miles)
- Likely Disconnected*: Groundwater greater than 50 feet below stream surface (0 miles)

**Streams could be connected to riparian or perched aquifers or shallow aquifers that are poorly characterized. More data are needed to confirm disconnected status.*

5-022.07_DeltaMendota_Grasslands

Data Sources:
CA Dept. of Water Resources Groundwater Elevation Data, gis.water.ca.gov/app/gicima/
NHD Plus V2 Streams, nhdplus.com/NHDPlus/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[18]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[19]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[20] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[18] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[19] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[20] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Cuyama Basin Groundwater Sustainability Plan (GSP), Cuyama Valley Basin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Cuyama Basin Groundwater Sustainability Agency's (GSA's) Cuyama Basin Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing sustainable groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be insufficient in addressing environmental beneficial uses and users.

The identification of environmental beneficial users, as well as their consideration when establishing the sustainability goal, undesirable results, minimum thresholds and measurable objectives were unreasonable (23 CCR §355.4(b)(4)) and lacked best available science (23 CCR §355.4(b)(1)). In the face of existing, severe overdraft, the GSP would allow groundwater management to largely ignore potential impacts to environmental beneficial users. This could result in irreparable harm to these beneficial users, undermining the intent of SGMA to achieve sustainability.

Many of the deficiencies can be addressed now, and we encourage the Department to require these corrections prior to approval. In some case, it may be difficult to address deficiencies within 180 days. In these cases, we strongly recommend that the Department, at a minimum, set clear expectations that these be corrected in the 2025 plan update and, to the degree that deficiencies are due to data gaps, that these data gaps be addressed in time to inform the 2025 update. SGMA's success is contingent upon avoiding undesirable results. Should the treatment of environmental beneficial users be indicative of the quality of the overall plan, then we recommend the Department deem the plan inadequate.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides the GSA's response to TNC's comments on the Draft GSP. Attachment G provides a map and method summary of potential ISWs.

<u>Our Key Considerations</u>

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We are disappointed to see the feedback that we provided on the draft GSP has been ignored in the final plan, as none of our 31 comments were adequately addressed in the Final GSP. This indicates poor engagement of environmental beneficial users, which undermines the intent of SGMA to ensure that sustainability be defined locally with the participation of all users. Based on our experience the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan" (23 CCR §355.4(b)(10)).

<u>TNC recommendation</u>: We strongly recommend that DWR require the GSA to prioritize stakeholder engagement through improvements to their stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters (ISWs) – We are pleased to see that the GSP identified ISWs, including providing depletion by reach. Improvements should be made to map the gaining and losing reaches, identify environmental users of surface water, and to account for the spatial and temporal variations in stream depletions that are inherent with California's Mediterranean climate. These components are necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). Please see our detailed feedback in Attachment B.

<u>Map and Assessment of potential ISWs</u>:
By assessing groundwater elevation data from the Cuyama Basin GSA, The Nature Conservancy has determined that within the Cuyama Basin GSP, 75.2 river miles are gaining, 21.2 are losing, and the rest are uncertain or likely disconnected. Attachment G contains a one-page method summary and a GSP-specific map of ISWs. The interconnected surface water displayed on the map is based on the minimum groundwater depth from measurements taken between Fall and Spring 2019.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 2,708 acres of potential GDEs occur in the GSA boundary. TNC developed the *Groundwater Dependent Ecosystems under*

SGMA: Guidance for Preparing GSPs[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

The plan does not to adequately identify, map and consider GDEs. We believe that this constitutes gaps in meeting plan evaluation criteria (1), (4) and (10), as defined in the 23 CCR §355.4(b). In addition, the Plan does not satisfy the requirement to identify GDEs (23 CCR §Section 354.16(g)) and consider beneficial users throughout the plan. Our review found that NC Dataset polygons were improperly removed from the GDE map based on the following:

- The GDE identification process did not take groundwater levels into consideration. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface". There is no way to know if these conditions exist unless groundwater levels are taken into account.
- The GDE identification process utilized aerial imagery in an incorrect manner. The GSP relied on aerial imagery to detect surface water, and then made the assumption that only GDEs present in inundated areas were connected to groundwater. This approach is incorrect for two reasons: 1) not all surface water is connected to groundwater, and 2) visually inspecting aerial imagery cannot detect 'groundwater occurring near the ground surface'. GDEs can rely on groundwater for some or all its water requirements, whether or not surface water is present. In California, GDE reliance on groundwater often vary by season, and depend on the availability of alternative water sources (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow).
- The removal of GDE units based on the presence of sandy, dry, and friable soils was not scientifically justified. The presence of this soil type does not preclude the possibility that the dominant plant species observed are reliant on groundwater at depths below the ground surface.

<u>TNC recommendation</u>: TNC recommends that the GSA utilize groundwater levels that represent interannual and inter-seasonal variability along with additional information provided in our Attachment D, which provides best practices for utilizing the NC Dataset to identify and consider GDEs throughout the GSP. Specifically, the GSA should use a Digital Elevation Model (DEM) when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment D.

Water Budget – We would like to commend the GSP for including the groundwater demands of native vegetation in the historical, current and projected water budgets.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

[1] *Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf*

TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. As a result, the monitoring network does not adequately characterize groundwater level conditions that can impact environmental beneficial users of groundwater (i.e., GDEs) and of surface water (e.g., freshwater aquatic species). Potential GDEs are located along surface water bodies where no shallow groundwater monitoring is proposed; therefore, GDEs are not being specifically addressed by the monitoring network in the GSP. Furthermore, the Cuyama River is not gaged inside the Cuyama Basin, so river flows in the Basin have been estimated based on measurements at downstream gages. Installation of more stream gages is necessary for the improvement of numerical model accuracy for the estimation of interconnected surface water depletion.

TNC recommendation: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data and stream gage data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess potential impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but *sustainable* groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Considering Nature under SGMA: A Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
		If NC Dataset *was* used:	The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
		If NC Dataset *was* used:	GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
	2.2.3 Water Budget *23 CCR §354.18*	Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
Sustainable Management Criteria	**3.2 Measurable Objectives** *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
Sustainable Management Criteria	**3.3 Minimum Thresholds** *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
Sustainable Management Criteria	**3.3 Minimum Thresholds** *23 CCR §354.28*	Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
Sustainable Management Criteria	**3.3 Minimum Thresholds** *23 CCR §354.28*	Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
Sustainable Management Criteria	**3.4 Undesirable Results** *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
Sustainable Management Criteria	**3.4 Undesirable Results** *23 CCR §354.26*	If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
Sustainable Management Criteria	**3.4 Undesirable Results** *23 CCR §354.26*	If hydrological data *are available* within/nearby the GDE	Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the Cuyama Basin Groundwater Sustainability Plan

A complete draft of the Cuyama Basin Groundwater Sustainability Plan (GSP), adopted in December 2019, was reviewed by TNC. Responses to comments are provided in Appendix 1D of the Final GSP. The response to comments is also provided in Attachment F of this letter. We reviewed the responses to comments and the text of the Final GSP to determine if changes were made to the Final GSP text that addressed TNC's previously submitted comments. This attachment lists our original comments on the complete Public Draft Final GSP, as submitted to the GSA during the public comment period, and states whether or not they were addressed in the Final GSP *[as green text within brackets]*. Comments are provided in the order of the checklist items included as Attachment A.

1.3.1 Description of Beneficial Uses and Users of Groundwater (p. 1-46 & 1-47)

[The GSA's response does not address our comment and no changes to the GSP text were made.] [Checklist item #1]: Environmental users of groundwater, including groundwater dependent ecosystems (GDEs), are acknowledged as beneficial users of groundwater in the GSP. Other species that depend on interconnected surface waters exist in Cuyama Basin and therefore should be identified and described. For any species that are no longer present in the basin, please provide scientific rationale and data to support this claim.

The information on environmental users in the Cuyama basin is readily available and includes the data and data sources. **Please refer to the following**:

- Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), which is provided by the Department of Water Resources and identifies potential GDEs - https://gis.water.ca.gov/app/NCDatasetViewer/
- In Fall 2018, The Nature Conservancy sent a list of freshwater species located in the Cuyama Basin, which is included as **Attachment C** of this letter. Please take particular note of the species with protected status.
- In addition to identifying and describing environmental beneficial users, SGMA requires that beneficial users be considered throughout the plan. The Nature Conservancy has identified each part of the GSP with this requirement. That list is available here: https://groundwaterresourcehub.org/importance-of-gdes/provisions-related-to-groundwater-dependent-ecosystems-in-the-groundwater-s. Please ensure that environmental beneficial users are addressed accordingly throughout the plan.

2.1.6 Basin Boundaries – Bottom of the Cuyama Basin (p. 2-26)

[The GSA's response does not address our comment and no changes to the GSP text were made.] [Checklist item #5]: It is currently unclear how existing well depths compare with the depth of the upper member of the Morales Formation. According to DWR's Hydrogeologic Conceptual Model BMP[2], "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** This will prevent

[2]Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf

the possibility of extractors with wells deeper than the basin boundary from claiming exemption of SGMA due to their well residing outside the vertical extent of the basin boundary.

2.1.7 Principal Aquifers and Aquitards (p. 2-26)

[The GSA's response does not address our comment and no changes to the GSP text were made.] [Checklist item #6]: In paragraph 1, "The aquifer is considered to be continuous and unconfined with the exception of locally perched aquifers resulting from clays in the formation". **Please provide more details on:**

- the location of perched aquifers
- whether perched aquifers are being used by domestic shallow wells, GDEs and/or are potentially interacting with surface water
- the vertical gradients between the perched aquifers and the recent and younger alluvium aquifers
- other aquifer characteristics that may be known (e.g., perched aquifer thickness, porosity, hydraulic conductivity)

2.2.8 Interconnected Surface Water Systems (p. 2-112)

[The GSA's response does not address our comment and no changes to the GSP text were made.] [Checklist item #8]: The model results are demonstrating that the entire river is an interconnected surface water system ("surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" 23 CCR §351(o)). Based on the annual average stream depletion by reach (Table 2-2), it appears that losing and gaining reaches of the Cuyama can be mapped. **Please distinguish the gaining and losing reaches.** The data provides seems to indicate:

- Gaining: Reach 1, Reach 3, Reach 6, Reach 8, Reach 9.
- Losing: Reach 2, Reach 4, Reach 5, Reach 7

2.2.9 Groundwater Dependent Ecosystems (p. 2-117)

SGMA requires that all beneficial uses and users, including GDEs, be considered in the development and implementation of GSPs (Water Code §10723.2). The GSP Regulations include specific requirements to identify (map) GDEs and consider them when determining whether groundwater conditions are having potential effects on beneficial uses and users. SGMA also requires an assessment of whether sustainable management criteria (including minimum thresholds and measurable objectives) may cause adverse impacts to beneficial uses, including GDEs, and that monitoring networks are designed to detect such impacts. Therefore, mapping GDEs is a critical first step for incorporating environmental considerations into GSPs.

[Checklist item #11]:

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* It appears that the preliminary desktop analysis, completed by Woodard & Curran and documented in Appendix D of the draft GSP, resulted an excessive elimination – totaling two-thirds – of the NC dataset polygons mapped in the Cuyama Basin. In particular, the methods and field verification approach described in the draft GSP failed take groundwater levels into consideration. SGMA defines GDEs as "ecological communities and species that depend on *groundwater emerging from aquifers or on groundwater occurring near the ground surface*". **We recommend that depth to groundwater contour maps are used to verify whether a connection**

to groundwater exists for polygons in the NC Dataset. **Please refer to Appendix D of this letter for best practices for using groundwater data to verify a connection to groundwater.**

More specific comments related to the desktop analysis approach (as described in Appendix D of the GSP) include:

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Inundation visible on aerial imagery – This method is inappropriate because it is not possible to know whether surface water is connected with groundwater by visually inspecting it with aerial imagery. For example, in some cases surface water can be completely disconnected from groundwater, so in this scenario this approach would falsely suggest that NC dataset polygons are connected to groundwater. Similarly, if surface water is not present, this method would also falsely suggest that NC dataset polygons are not connected to groundwater if plant communities and the species they support are accessing groundwater beneath the surface. This method also fails to account for the fact that GDEs can rely on groundwater for some or all its water requirements, which in California often vary by season, and depend on the availability of alternative water sources (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow).
    - If aerial imagery is to be used, a range of dates should be selected to reflect the California's Mediterranean climate, seasonal variations and water year types.
    - Phreatophytes (groundwater-dependent vegetation) often rely on groundwater that is occurring near the ground surface via their rooting network. Because these sources of groundwater are not detectable using aerial imagery, the images should be compared with contoured groundwater levels to determine whether groundwater levels are close enough to vegetation root zones.
    - We suggest the methods be revised and clarified accordingly.
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Saturation visible on aerial imagery could indicate many different conditions, including standing water or saturated soils that may be ephemeral, intermittent, or permanent in nature. To help verify what the images actually indicate, this method should be coupled with more advanced remote sensing methods. Please clarify if this was the case.
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Dense riparian and/or wetland vegetation visible on aerial imagery can help identify potential GDEs but is not an appropriate method to screen for whether a polygon is supported by groundwater and in fact a GDE. The presence of sparse vegetation also does not preclude the possibility that vegetation are using groundwater. Many desert and semi-arid environments with sparse vegetation can still be groundwater dependent ecosystems.

More specific comments related to the GDE field validation approach (as described in Appendix D of the draft GSP):

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The removal of Probable Non-GDE 1 and Probable Non-GDE 2 was based on the presence of sandy, dry, and friable soils was not scientifically justified. The presence of this soil type does not preclude the possibility that the dominant plant species observed are reliant on groundwater at depths below the earth surface. For example, a rooting depth of 13 feet has been observed for Ericameria nauseosa and >4 feet for Eriogonum fasiculatum, and the capillary fringe associated with those rooting networks could be accessing groundwater from deeper depths, depending on the hydraulic conductivity of the substratum. For more rooting depth data, please refer to TNC's global rooting depth database, available at: https://groundwaterresourcehub.org/gde-tools/gde-rooting-depths-database-for-gdes/

[Checklist items #12 & 13]:

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Decisions to remove, keep, or add polygons from the NC dataset into a basin GDE map should be based on best available science in a manner that promotes transparency and accountability with stakeholders. Any polygons that are removed, added, or kept should be inventoried in the submitted shapefile to DWR, and mapped in the plan. **We recommend revising Figure 2-64 to reflect these requirements.**

[Checklist item #17]:

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Groundwater conditions within GDEs should be briefly described within the portion of the Basin Setting Section where GDEs are being identified. Please refer to **Attachment E** of this letter for details on a new, free online tool that enables groundwater sustainability agencies to assess historical and current trends of growth and moisture content in vegetation using 35 years of satellite imagery for all of the polygons in the NC dataset.

[Checklist item #19]:

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Not all GDEs are created equal. Some GDEs may contain legally protected species or ecologically rich communities, whereas other GDEs may be highly degraded with little conservation value. Including a description of the types of species (protected status, native versus non-native), habitat, and environmental beneficial uses (see Worksheet 2, p.74 of GDE Guidance Document) can be helpful in assigning an ecological value to the GDEs. Identifying an ecological value of each GDE can help prioritize limited resources when considering GDEs as well as prioritizing legally protected species or habitat that may need special consideration when setting sustainable management criteria.

<u>3.2.1 Undesirable Results Statements - Chronic Lowering of Groundwater Levels (p. 3-2) and 3.3.1 Evaluation of Presence of Undesirable Results – Chronic Lowering of Groundwater Levels (p. 3-6)</u>

[Checklist items #30-46]:

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Identification of Undesirable Results – significant adverse impacts to GDEs can occur if 30% of representative monitoring wells fall below their minimum groundwater elevation thresholds for two consecutive years. The proposed approach could work if management areas were established to "identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors" [23 CCR §351(r)]. But, as it is written now, significant and unreasonable adverse impacts to GDEs could occur if the exceedance of minimum thresholds disproportionately occurs in representative monitoring wells close to GDEs (e.g., 3 out of the 60 wells minimum thresholds are exceeded for 3 years are causing adverse impacts to GDEs, but because the definition of undesirable results (18 out of 60 wells) is not met, there is no formal recognition that undesirable results are occurring). **We recommend that groundwater levels that are protective of GDEs be considered when establishing minimum thresholds for groundwater levels across the basin. Please refer to Step 2 of *GDEs under SGMA: Guidance for Preparing GSPs*[1] for more details.**

3.2.6 Undesirable Results Statements - Depletions of Interconnected Surface Water (p. 3-5) [Checklist items #30-46]:

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Under the Potential Effects of Undesirable Results subsection, "If depletions of interconnected surface water were to reach Undesirable Results, groundwater dependent ecosystems could be affected" **should also include potential effects on environmental surface water users, land uses (e.g., fishing/hunting, hiking, boating), and property interests (e.g., privately and publicly protected conservation lands and open spaces, including wildlife refuges, parks, and natural preserves) [23 CCR §354.26(b)(3)].** Please also provide more details on how these various beneficial users could be adversely affected. SGMA also requires that depletions of interconnected surface water also consider adverse impacts on beneficial uses of surface water [23 CCR 354.28(6)].
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* In addition to identifying GDEs in the basin, The Nature Conservancy recommends identifying beneficial users of surface water, which include environmental users. This is a critical step, as it is impossible to define "significant and unreasonable adverse impacts" without knowing *what* is being impacted, nor is possible to monitor ISWs in a way that can "identify adverse impacts on beneficial uses of surface water" [23 CCR §354.34(c)(6)(D)]. For your convenience, we've provided a list of freshwater species within the boundary of the Cuyama Basin in **Attachment C**. Our hope is that this information will help your GSA better evaluate and monitor the impacts of groundwater management on environmental beneficial users of surface water. We recommend that after identifying which freshwater species exist in your basin, especially federal and state listed species, that you contact staff at the Department of Fish and Wildlife (DFW), United States Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Services (NMFS) to obtain their input on the groundwater and surface water needs of the organisms on the freshwater species list, and how best to monitor them. Because effects to plants and animals are difficult and sometimes impossible to reverse, we recommend erring on the side of caution to preserve sufficient groundwater conditions to sustain GDEs and ISWs.
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please also provide more details on when, where, and how**

groundwater changes can adversely affect these various beneficial users. Are there particular species, with legal protection, that already have known thresholds that need special consideration? The more specific the definition of what an adverse impact to beneficial users of groundwater and surface water looks like, the easier it is to quantify minimum thresholds, measurable objectives, and interim milestones that are protective of that definition.

<u>3.3.6 Evaluation of the Presence of Undesirable Results - Depletions of Interconnected Surface Water (p. 3-8)</u>
[Checklist items #30-46]:

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please be more specific on what measurements were used to show that groundwater gradients along interconnected surface water bodies in the Cuyama basin are not in an undesirable condition.** How were these gradients determined?
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Analysis of Interconnected Surface Waters in Section 2.2.8, particularly Table 2.2, demonstrate that depletions of interconnected surface water are occurring, meaning that adverse impacts to beneficial uses and users could be occurring. **Thus, it is inadequate to state that "depletion of interconnected surface water is not identified to be in an undesirable condition" without evaluating potential effects to beneficial users.**

<u>4.5.4 Groundwater Level Monitoring Network – Representative Monitoring (p. 4-41 & 4-42)</u>
[Checklist items #47-49]:

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please identify which representative monitoring wells are capable of monitoring groundwater level conditions that can impact environmental beneficial users of groundwater (i.e., GDEs) and of surface water (e.g., freshwater aquatic species).** Refer to Best Practice #4 in Attachment D to this letter for technical guidance.

<u>4.10 Depletions of Interconnected Surface Water Monitoring Network (p. 4-66)</u>
[Checklist items #47-49]:

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **The improvement of numerical model accuracy for the estimation of interconnected surface waters should also include the installation of clustered or nested wells and the installation of shallow monitoring wells around GDEs and the Cuyama River to resolve data gaps that were identified in Section 2.2.10**:
    - The Cuyama River is not gaged inside the Cuyama Basin, so flows of the river in the Basin have been estimated based on measurements at downstream gages.
    - Vertical gradients in the majority of the Basin are not understood due to the lack of wells with completions of different depths located near each other.
    - GDEs could be evaluated in greater detail

- Information about many of the wells in the Basin is incomplete, and additional information is needed regarding well depths, perforation intervals and current status.
- Due to sporadic monitoring by a variety of monitoring entities, a long period of record of monitoring groundwater levels does not exist in many areas in the Basin.

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please identify appropriate biological indicators that can be used to monitor potential impacts to environmental beneficial users due to groundwater conditions. Refer to Appendix E of this letter for an overview of a free, new online tool for monitoring the health of GDEs over time.**

<u>5.2.2 Minimum Thresholds, Measurable Objectives, and Interim Milestones - Chronic Lowering of Groundwater Levels (p. 5-6 thru p. 5-9)</u>
[Checklist items #26-29]:

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Selecting thresholds by using groundwater elevation measurements closest to (but not before) January 1, 2015 is inadequate for identifying minimum thresholds or measurable objectives. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions fails to capture the seasonal and interannual variability typical of California's climate. Hydrology is not static. Measurable objectives are intended to be set with enough operational flexibility to permit seasonal and interannual fluctuations that occur in California. **We recommend that you consider using a baseline approach to better capture seasonality and water year types.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* January 1, 2015 was at the height of California's historic drought, a period of time that was characterized by adverse impacts to domestic well owners (e.g., dry wells), GDEs (e.g., water stress impacts on growth, reproduction, and even mortality due to lack of groundwater), and surface water users (e.g., lower streamflows). **The onus is on the GSA to determine whether groundwater conditions (due to groundwater pumping) exacerbated impacts to these beneficial users. And if so, to recognize these impacts and establish thresholds and measurable objectives that can avoid adverse impacts to beneficial users caused by groundwater in all water year types.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* While total well depth information is helpful in considering adverse impacts to beneficial users of groundwater (e.g., domestic, irrigation, and municipal wells), it fails to consider adverse impacts to GDEs and environmental beneficial users of surface water in interconnected surface waters. **Environmental beneficial users of groundwater need to be considered when establishing measurable thresholds, measurable objectives, and interim milestones. Please refer to Step 2 of *GDEs under SGMA: Guidance for Preparing GSPs*[1] for how this can be accomplished.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please describe any differences between the selected minimum**

threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs, as required [23 CCR §354.28 (b)(5)].

5.7 Minimum Thresholds, Measurable Objectives, and Interim Milestones - Depletions of Interconnected Surface Water (p. 5-26)
[Checklist items #26-29]:

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **It is highly doubtful that January 1, 2015 surface water conditions can be considered "normal" (2nd sentence in 2nd paragraph); please provide data to substantiate this claim.** January 1, 2015 was at the height of California's historic drought, a period of time that was characterized by adverse impacts to domestic well owners (e.g., dry wells), GDEs (e.g., water stress impacts on growth, reproduction, and even mortality due to lack of groundwater), and surface water users (e.g., lower streamflows).
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please provide more data and an elaborated description on how current basin conditions have not varied from January 1, 2015 conditions.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Even if current basin conditions may not have varied from January 1, 2015, **the onus is on the GSA to determine whether groundwater conditions are causing any adverse impacts to beneficial users. And if so, to recognize these impacts and establish thresholds and measurable objectives that can avoid adverse impacts to beneficial users caused by groundwater in all water year types.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* According to Table 2-2 in the Draft GSP, 5994 AF of surface water was depleted in 2017:

Reach	Depletion in AF
2	19.9
3	300.4
4	67.8
5	906
7	4700.3
Total	**5994.4**

  Please investigate whether these depletions in surface water are adversely impacting instream flow conditions and groundwater levels in riparian areas for environmental beneficial users, especially legally protected species.

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please describe any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters [23 CCR §354.28 (b)(5)].**

7. Projects and Management Actions (p. 7-1)
[Checklist items #50 - 51]:

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Please describe how the projects described in this chapter and their benefits will help "maintain a sustainable groundwater resource for beneficial users of the Basin", including environmental users, as stated in the sustainability goal for the Cuyama Basin.
- *[No response required.]* For more case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

Attachment C

Freshwater Species Located in the Cuyama Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Cuyama Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[3]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[4] as well as on The Nature Conservancy's science website[5].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Anas americana	American Wigeon			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya collaris	Ring-necked Duck			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Cistothorus palustris palustris	Marsh Wren			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Limnodromus scolopaceus	Long-billed Dowitcher			
Megaceryle alcyon	Belted Kingfisher			
Numenius americanus	Long-billed Curlew			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Porzana carolina	Sora			

[3] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[4] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[5] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Artemia franciscana	San Francisco Brine Shrimp			
Cyprididae fam.	Cyprididae fam.			
Hyalella spp.	Hyalella spp.			
FISH				
Gila orcutti	Arroyo chub		Special Concern	Vulnerable - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		Special Concern	Near-Threatened - Moyle 2013
Oncorhynchus mykiss - SCCC	South Central California coast steelhead	Threatened	Special Concern	Vulnerable - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern	ARSSC
Pseudacris cadaverina	California Treefrog			ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Agabus spp.	Agabus spp.			
Ambrysus mormon				Not on any status lists
Ambrysus spp.	Ambrysus spp.			
Ameletus spp.	Ameletus spp.			
Anacaena spp.	Anacaena spp.			
Anax junius	Common Green Darner			
Anax walsinghami	Giant Green Darner			
Apedilum spp.	Apedilum spp.			
Argia lugens	Sooty Dancer			
Argia nahuana	Aztec Dancer			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetidae fam.	Baetidae fam.			
Baetis adonis	A Mayfly			

Baetis spp.	Baetis spp.			
Belostomatidae fam.	Belostomatidae fam.			
Berosus spp.	Berosus spp.			
Brillia spp.	Brillia spp.			
Callibaetis spp.	Callibaetis spp.			
Capniidae fam.	Capniidae fam.			
Centroptilum spp.	Centroptilum spp.			
Chaetarthria ochra				Not on any status lists
Chaetarthria pallida				Not on any status lists
Chaetocladius spp.	Chaetocladius spp.			
Chironomidae fam.	Chironomidae fam.			
Cinygmula spp.	Cinygmula spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corydalidae fam.	Corydalidae fam.			
Cricotopus spp.	Cricotopus spp.			
Culicidae fam.	Culicidae fam.			
Diamesa spp.	Diamesa spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Drunella coloradensis	A Mayfly			
Drunella spp.	Drunella spp.			
Enochrus carinatus				Not on any status lists
Enochrus cristatus				Not on any status lists
Enochrus hamiltoni				Not on any status lists
Enochrus piceus				Not on any status lists
Enochrus spp.	Enochrus spp.			
Ephemerella spp.	Ephemerella spp.			
Ephydridae fam.	Ephydridae fam.			
Eubrianax edwardsii				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Euryhapsis spp.	Euryhapsis spp.			
Gumaga spp.	Gumaga spp.			
Helochares normatus				Not on any status lists
Hydraena spp.	Hydraena spp.			
Hydrophilidae fam.	Hydrophilidae fam.			
Hydroporus spp.	Hydroporus spp.			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Hydryphantidae fam.	Hydryphantidae fam.			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Ischnura spp.	Ischnura spp.			
Isoperla spp.	Isoperla spp.			
Laccobius spp.	Laccobius spp.			
Lepidostoma spp.	Lepidostoma spp.			
Lestes congener	Spotted Spreadwing			
Libellula luctuosa	Widow Skimmer			
Libellula saturata	Flame Skimmer			
Libellulidae fam.	Libellulidae fam.			
Limnophyes spp.	Limnophyes spp.			
Mesocapnia spp.	Mesocapnia spp.			
Micrasema spp.	Micrasema spp.			
Micropsectra spp.	Micropsectra spp.			
Neoclypeodytes plicipennis				Not on any status lists
Ochthebius gruwelli				Not on any status lists
Oecetis spp.	Oecetis spp.			
Oreodytes spp.	Oreodytes spp.			

Orthocladius spp.	Orthocladius spp.			
Paltothemis lineatipes	Red Rock Skimmer			
Paracladopelma spp.	Paracladopelma spp.			
Parakiefferiella spp.	Parakiefferiella spp.			
Paraleptophlebia spp.	Paraleptophlebia spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Paratendipes spp.	Paratendipes spp.			
Peltodytes simplex				Not on any status lists
Phaenopsectra spp.	Phaenopsectra spp.			
Physemus minutus				Not on any status lists
Plathemis lydia	Common Whitetail			
Plathemis subornata	Desert Whitetail			
Polypedilum spp.	Polypedilum spp.			
Postelichus spp.	Postelichus spp.			
Procladius spp.	Procladius spp.			
Progomphus borealis	Gray Sanddragon			
Prosimulium spp.	Prosimulium spp.			
Psectrocladius spp.	Psectrocladius spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Sanfilippodytes spp.	Sanfilippodytes spp.			
Serratella spp.	Serratella spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sperchontidae fam.	Sperchontidae fam.			
Stictotarsus spp.	Stictotarsus spp.			
Stictotarsus striatellus				Not on any status lists
Sympetrum corruptum	Variegated Meadowhawk			
Taenionema spp.	Taenionema spp.			
Tanytarsus spp.	Tanytarsus spp.			
Telebasis salva	Desert Firetail			
Tinodes spp.	Tinodes spp.			
Tipulidae fam.	Tipulidae fam.			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus spp.	Tropisternus spp.			
Tvetenia spp.	Tvetenia spp.			
MOLLUSKS				
Physa spp.	Physa spp.			
PLANTS				
Alnus rhombifolia	White Alder			
Anemopsis californica	Yerba Mansa			
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Carex senta	Western Rough Sedge			
Castilleja minor minor	Alkali Indian-paintbrush			
Cicuta maculata angustifolia	Spotted Water-hemlock			
Elatine californica	California Waterwort			
Eleocharis parishii	Parish's Spikerush			
Epilobium campestre	NA			Not on any status lists
Isolepis cernua	Low Bulrush			
Juncus macrophyllus	Longleaf Rush			
Juncus xiphioides	Iris-leaf Rush			
Mimulus guttatus	Common Large Monkeyflower			
Mimulus parishii	Parish's Monkeyflower			
Myosurus minimus	NA			
Perideridia parishii latifolia	Parish's Yampah			
Perideridia pringlei	Pringle's Yampah		Special	CRPR - 4.3
Phacelia distans	NA			
Platanus racemosa	California Sycamore			
Pluchea odorata odorata	Scented Conyza			
Rumex conglomeratus	NA			
Salix exigua exigua	Narrowleaf Willow			

Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Stachys albens	White-stem Hedge-nettle			
Veronica americana	American Speedwell			

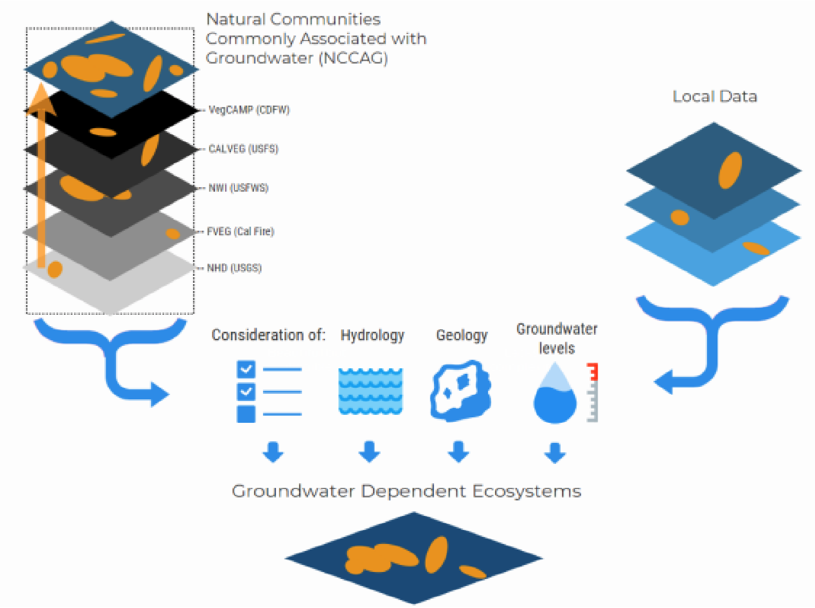
Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[6] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[7]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[6] *NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/*

[7] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[8]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[9] on the Groundwater Resource Hub[10], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[8] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[9] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[10] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

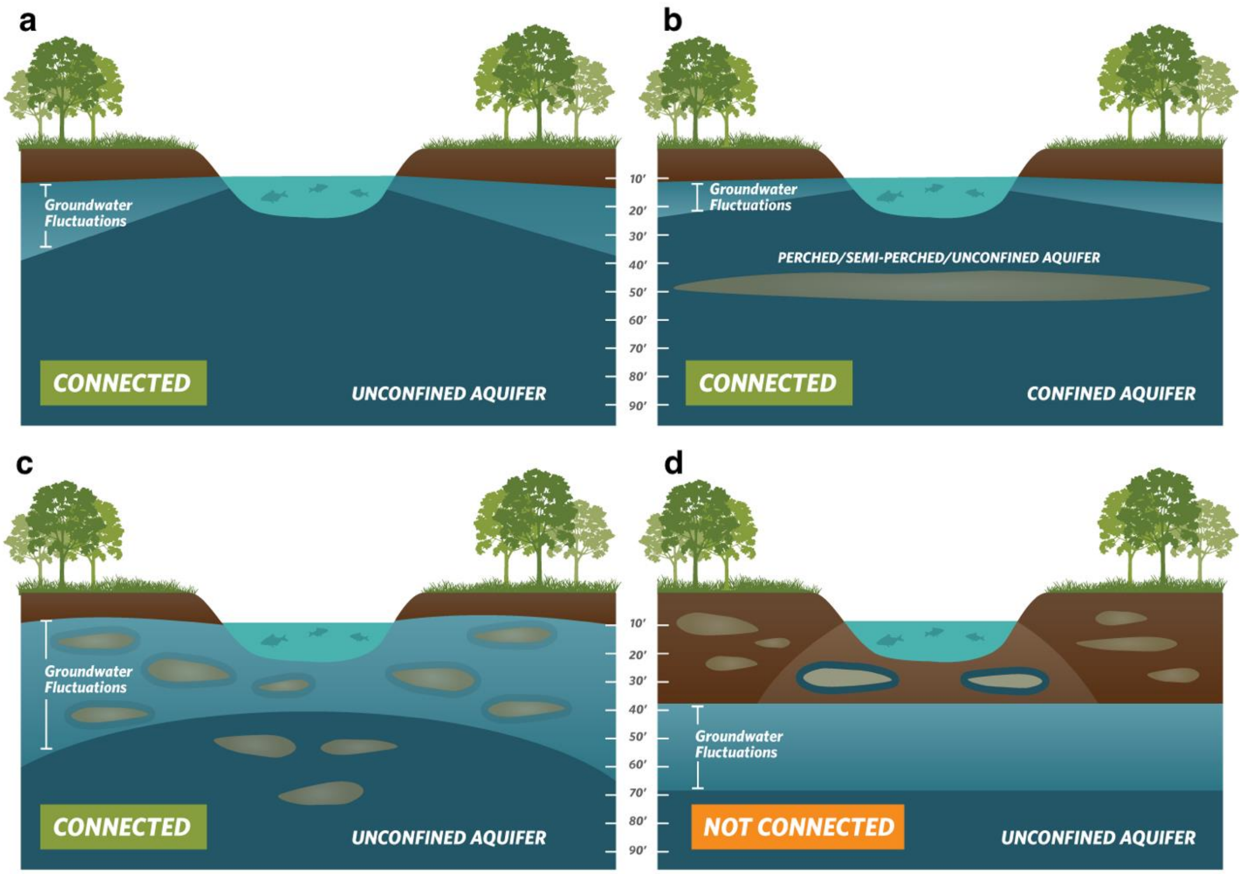

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[11] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[12] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[13] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[14]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network (see Best Practice #6).

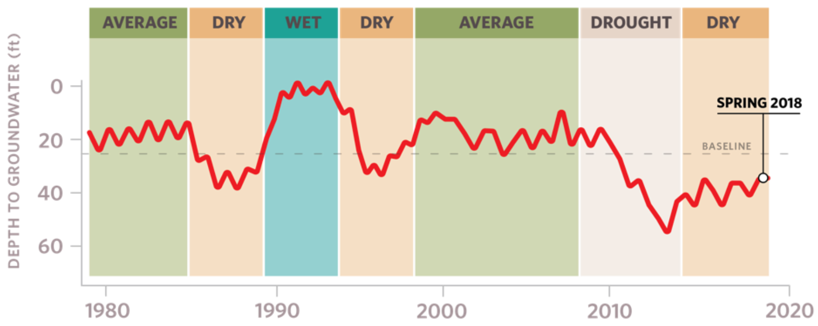

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[11] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[12] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[13] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[14] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[15], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

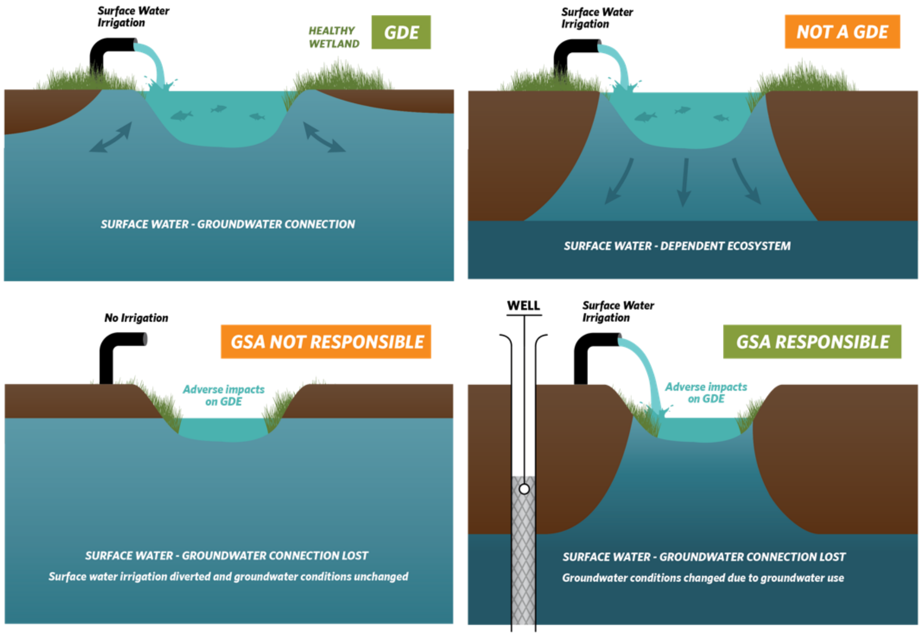

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[15] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

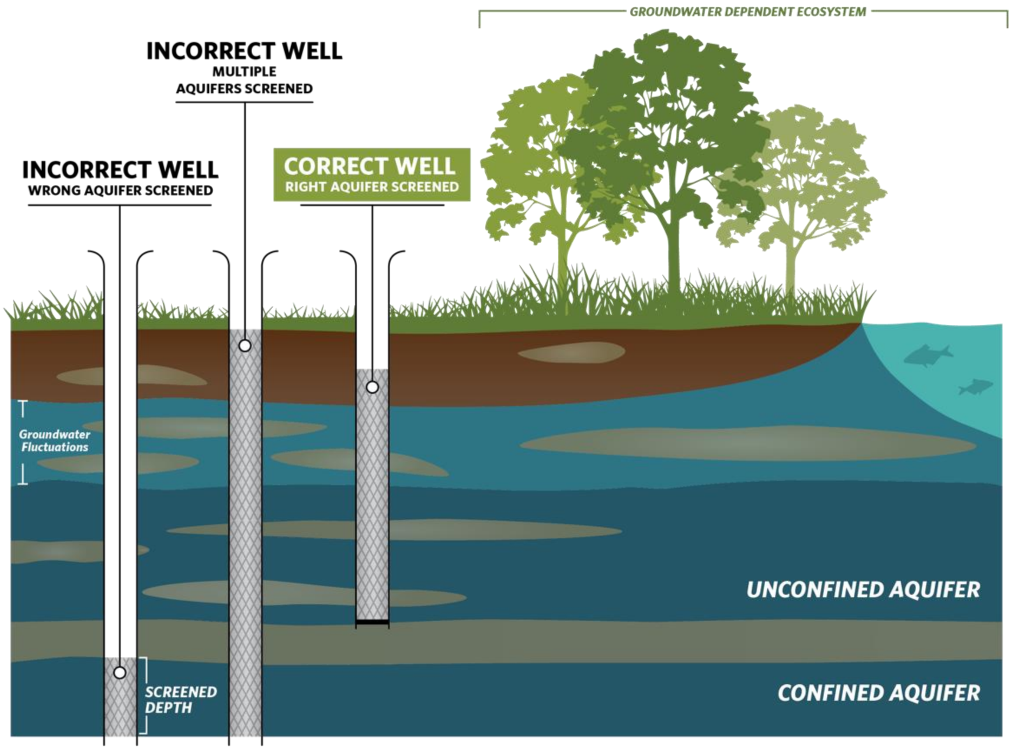

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[16] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

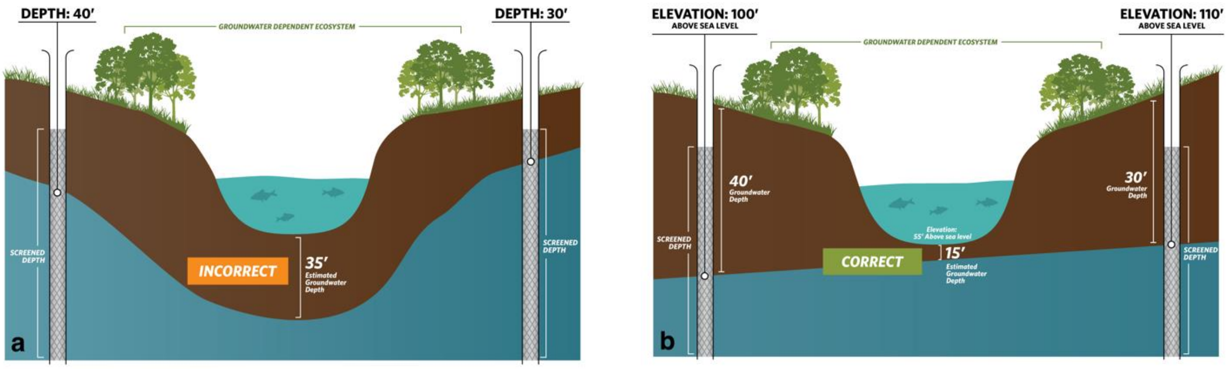

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

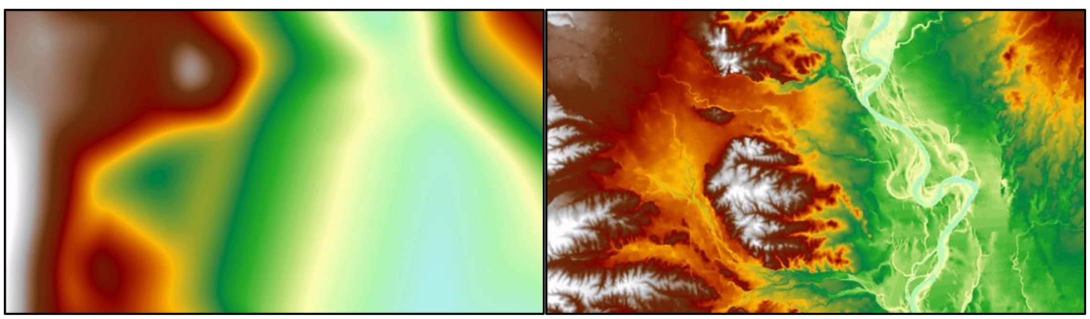

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

16 USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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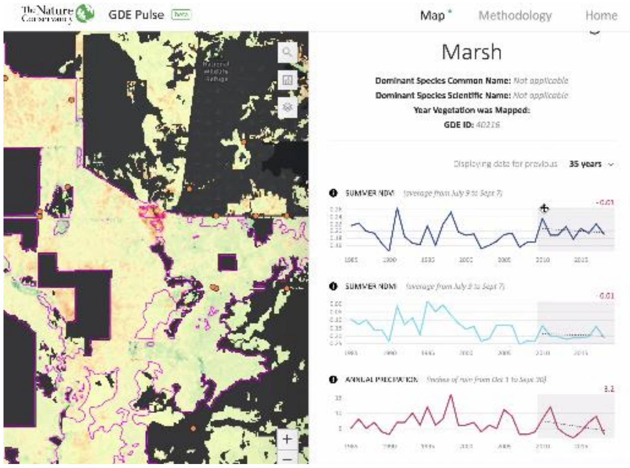
Visit
https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[17]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[18]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[17] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[18] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F

The GSA Response to TNC Comments on the Draft GSP will be located on DWR's SGMA Portal as Part 2 of 2.

Attachment G

Mapping Likely Interconnected Surface Water

The Nature Conservancy, California, May 2020

Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, ISW is defined as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:

The groundwater elevation data, available for Spring and Fall 2019, comes from the Cuyama Basin Groundwater Sustainability Agency. These data are continuous raster layers, developed from groundwater measurements and topographic features, that approximate groundwater elevation. These data are represented as continuous raster layers that approximates "feet above or below mean sea level" based on groundwater well measurements. To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

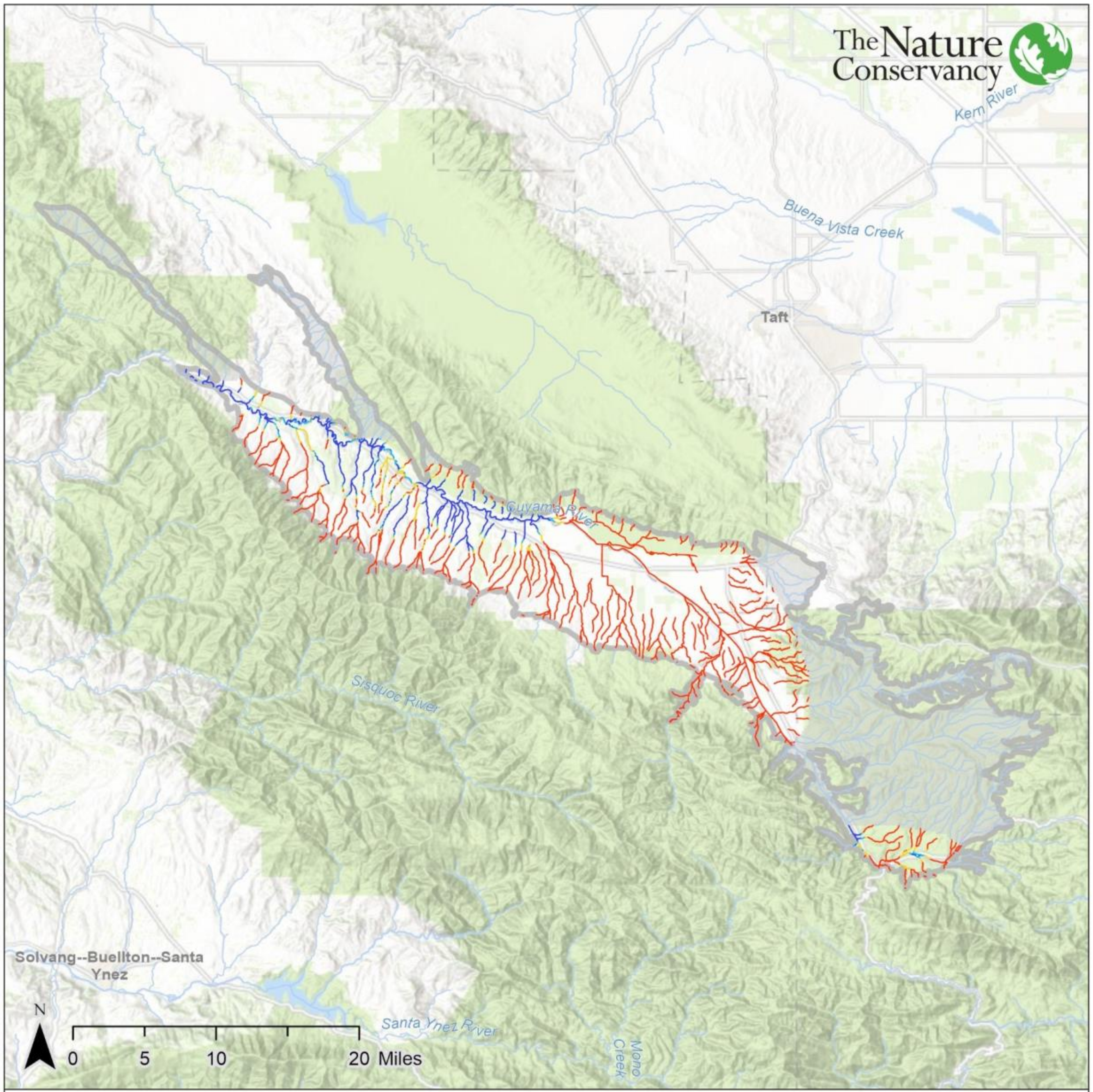
The map splits groundwater depth into four categories:

- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.
- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.

Interconnected Surface Water: Minimum Groundwater Depth (2019)

Cuyama Basin GSP



Legend

- Groundwater Sustainability Agency (GSA)
- No groundwater depth data available
- Rivers and streams with no depth data (330.3 miles)

Minimum Groundwater Depth

- Connected - Gaining: Groundwater at or above stream surface (75.2 miles)
- Connected - Losing: Groundwater within 20 feet of stream surface (21.2 miles)
- Uncertain: Groundwater within 20-50 feet of stream surface (28.8 miles)
- Likely Disconnected: Groundwater greater than 50 feet below stream surface (355.1 miles)

3-013_CuyamaValley

Data Sources:
Cuyama Basin GSA Groundwater Elevation Data
NHD Plus V2 Streams, nhdplus.com/NHDPlus/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[19]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[20]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[21] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[19] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[20] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[21] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Eastern San Joaquin Subbasin Groundwater Sustainability Plan (GSP)

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Eastern San Joaquin Groundwater Authority (ESJGWA) Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing *sustainable* groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be incomplete in addressing environmental beneficial uses and users.

While the GSP addressed environmental beneficial users in some respects, our review finds that portions of the GSP should be remedied before being approved. Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address within 180 days. In these cases, we strongly recommend that the Department set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that they be addressed in time to inform the 2025 update.

Our review found that the sustainability goal, undesirable results, minimum thresholds and measurable objectives (collectively, the SMC) largely or completely neglected to reasonably consider impacts to environmental beneficial users (23 CCR §355.4(b)(4)) and/or employ the best available science (23 CCR §355.4(b)(1)). In the face of existing, severe overdraft, the GSP would allow for further significant reductions in groundwater storage and associated groundwater levels, without consideration for negative impacts to GDEs and/or ISWs. This could result in irreparable harm to environmental beneficial users, including vulnerable species subject to state and federal laws, and undermine the intent of SGMA to achieve sustainability.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment D provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment E provides the GSA's response to TNC's comments on the Draft GSP. Attachment F provides a map and method summary of possible ISWs.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We are disappointed to see the feedback that we provided on the draft GSP has been largely ignored in the final plan, as only 10 out of 58 of our comments on the draft GSP were addressed. This indicates poor engagement of environmental beneficial users, which undermines the intent of SGMA to ensure that sustainability be defined locally with the participation of all users. Based on our experience, the GSP did not "adequately respond(d) to comments that raise credible technical or policy issues with the Plan" (23 CCR §355.4(b)(10)).

TNC recommendation: We strongly recommend that the GSA prioritize stakeholder engagement through improvements to the stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters – The GSP incorrectly excluded potential and/or actual ISWs because the plan did not employ the best available science. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)).

ISWs were evaluated by comparing monthly groundwater elevations from the historical calibration of the Eastern San Joaquin Water Resources Model to streambed elevations to identify interconnected gaining and losing streams. The GSP determined whether or not a stream reach is interconnected based on whether modeling indicated the interconnection existed more than 75 percent of the time. However, limiting the extent of ISWs based on intermittent connection is not consistent with the regulations (23 CCR §351(o)), which define ISWs as "surface water that is hydraulically connected *at any point* by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted." (emphasis added) "At any point" has both a spatial and temporal component. Even short durations of interconnection between groundwater and surface water can be crucial for surface water flow and support of wetlands. Using temporal cut-off method, particularly when identifying ISWs is recognized as a data gap, will not adequately protect the environmental beneficial uses of surface water from significant and unreasonable adverse impacts related to groundwater extraction.

Map and Assessment of potential ISWs:
By combining multiple years and seasons of groundwater depth data, The Nature Conservancy has determined that within the ESJGWA GSP, 25.7 river miles are gaining, 164.6 are losing, and the rest are uncertain or likely disconnected (based on streams with available groundwater depth data). Attachment G contains a one-page method summary and a GSP-specific map of ISWs.

The interconnected surface water displayed on the map is based on the minimum groundwater depth estimated by the California Department of Water Resources between 2011 and 2018. TNC's analysis (Attachment F) of ISW indicates that additional ISW exist on the North and South Mokulumne Rivers around Staten Island, and on the Mokulumne River near Lodi. These and other areas are not included in the results from the Eastern San Joaquin Resources Model.

Note: In most cases, the groundwater depth data used to generate the ISW map does not include perched aquifers. As such, some streams marked as disconnected could in actuality, be connected.

TNC recommendation: Until a disconnection can be proven, TNC recommends that the GSP include all potential and confirmed ISWs and prioritize the installation of additional shallow wells at locations near high value or sensitive resources that are vulnerable to significant and unreasonable adverse impacts. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystems – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 31,010 acres of potential GDEs occur in the GSA boundary. TNC developed the *Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs*[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

The plan does not adequately identify, map and consider GDEs. We believe that this falls short of meeting plan evaluation criteria (1), (4) and (10), as defined in the 23 CCR §355.4(b). In addition, the Plan does not satisfy the requirement to identify GDEs (23 CCR §Section 354.16(g)) and consider beneficial users throughout the plan. Our review found that NC Dataset polygons were improperly removed from the GDE map based on the following:

- GDEs were rejected on the basis that groundwater levels were greater than 30 feet at a single point in time. This is approach is inconsistent with the best available science because groundwater levels fluctuate over seasons and between years due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Justifying the removal of NC dataset polygons solely based on this criterion does not acknowledge that groundwater levels temporally vary and the fact that many plant species within GDEs can access groundwater depths beyond 30 feet or have adapted water stress strategies to deal with intermittent periods of deep groundwater levels. Using this methodology disregards groundwater fluctuations and can leave many GDEs unprotected in the GSP.

TNC recommendation: Request that the GSA use groundwater levels that represent interannual and inter-seasonal variability and utilize additional information provided in our guidance document (Attachment C) to identify and consider GDEs throughout the GSP. Specifically, the GSA should use Digital Elevation Model (DEM) when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment C.

Water Budget – We would like to commend the Eastern San Joaquin Subbasin GSP for including the groundwater demands of wetlands, GDEs, native vegetation and riparian vegetation in the

[1] Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

historical, current and projected water budgets as part of "Refuge, Native, and Riparian Evapotranspiration."

Sustainable Management Criteria – The GSP took steps towards addressing environmental beneficial users in the SMCs, however, the plan should be improved to describe potential effects on all environmental users of groundwater and interconnected surface waters, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). Undesirable results related to depletions of interconnected surface waters are defined and evaluated only for major streams and rivers. This assessment should be extended to smaller creeks and streams that the GSP assumes are solely used for the conveyance of irrigation water, as these areas may represent GDEs and/or ISWs. These creeks and streams support significant recognized aquatic habitat, wetlands and riparian zones that represent potential environmental beneficial uses and users of groundwater. The minimum thresholds assume that depletions equivalent to historical low groundwater level conditions do not negatively impact ISWs or GDEs, which may be an incorrect assumption.

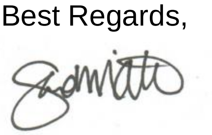
TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for all ISWs – from major rivers to small streams – avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

The Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. As a result, the monitoring network is not sufficient to establish a linkage between groundwater extraction and resulting potential impacts to GDEs and ISWs. The cause-effect relationship between groundwater levels and the biological responses that could result in significant and unreasonable impacts to ISWs and GDEs depends on a number of factors. Therefore, the proposed monitoring is not sufficient to detect impacts to GDEs and ISWs.

TNC recommendation: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) install additional monitoring wells and stream gages near potential ISWs and GDEs to further evaluate, monitor, manage and protect areas with ISWs and GDEs; (3) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (4) determine what ecological monitoring can be used to assess potential impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but *sustainable* groundwater management that considers the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,



Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be “significant and unreasonable” are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR’s GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Eastern San Joaquin Subbasin Groundwater Sustainability Plan

The Eastern San Joaquin Subbasin Groundwater Sustainability Plan (GSP), adopted in December 2019, was reviewed by TNC. Responses to comments are provided in Appendix J (Comments 660–694). The GSA response to our draft comment letter is also provided in Attachment E of this letter. We reviewed the responses to comments and the text of the Final GSP to determine if changes were made to the Final GSP text that addressed TNC's previously submitted comments. This attachment lists our original comments on the complete Public Draft GSP, as submitted to the Eastern San Joaquin Groundwater Authority (EJSGWA) during the public comment period, and states whether or not they were addressed in the Final GSP [as green text within brackets]. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 – Notice & Communication (23 CCR §354.10).

- [Section 1.3.1 Beneficial Uses and Users in the Subbasin (pp. 1-42)] [Checklist item 1]
  - *[Section 1.2.1.1 has been updated to include some of this information. Thank you for recognizing some of the protected areas within the Eastern San Joaquin Subbasin that are environmental users of groundwater. The remaining protected areas should also be recognized.]* Caswell Memorial State Park is incorrectly referred to as being located outside the Eastern San Joaquin Subbasin. The following additional protected lands are located near surface waters within the Subbasin that may be interconnected with groundwater, and/or may rely at least partly on groundwater to support vegetation and sensitive natural communities. These protected lands represent potential beneficial users of groundwater: Durham Ferry State Recreational Area, a small portion (approximately 200 acres) of San Joaquin River National Wildlife Refuge, Army Corps Park, Vernalis Riparian Habitat (Public Conservation Lands), Seegers Preserve, Cabral Island Preserve, Machado Preserve, Hansen Preserve, Micke Grove Park and Zoo, Oak Grove Regional Park, Nakagawa Preserve, El Rio Farms Preserve, Lodi Lake Nature Area, Woodbridge Regional Park, Woodbridge Ecological Preserve, White Slough WA, Nuss Farms, Beck Preserve, Hilder Preserve, Staten Island Ranch, Burchel Preserve, and Ishizuka Preserve. The authors referred to the San Joaquin County General Plan documents, including background reports, for information regarding these important resources. These potential beneficial groundwater users should be described in the text on pp. 1-18 and shown in Figure 1-11. **Please include a description recognizing all of the**

protected areas in the Subbasin and their beneficial groundwater uses.

  - *[The GSA responded, "Comment noted" and indicated that this information is beyond the scope of the GSP and can be considered in future updates. No text changes were made. Managed wetlands may be partially dependent on groundwater; therefore, removal of these GDEs from consideration is not adequately justified or scientifically credible.]* Section 2.2.8 includes a geospatial analysis that removes managed wetlands from consideration as GDEs. **The managed wetlands in the Subbasin should be identified in this section.**

Checklist Item 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8).

- *[The GSA's response stated that the comment goes above and beyond the requirements of SGMA and can be evaluated in future iterations of the GSP. No text changes were made. We appreciate the GSA's willingness to further describe GDEs and ISWs and associated monitoring and management programs in future GSPs; however, it should be noted that until these resources and programs are recognized, adequate coordination of GSP implementation with environmental stakeholders cannot be assured.]* [Section 1.2.1 Description of Plan Area (1-10 to 1-23)] Critical habitat is known to exist for protected aquatic species, such as California Tiger Salamander, Steelhead, Delta Smelt, Giant Gartersnake and California Red-Legged Frog in and around the Subbasin (https://fws.maps.arcgis.com/home/webmap/viewer.html?webmap=9d8de5e265ad4fe09893cf75b8dbfb77). There are likely ongoing monitoring programs associated with critical habitat areas and the protected lands. **Please include a description of these habitat areas, and associated programs and requirements pertinent to ISWs, GDEs and wetlands. Identify areas where critical habitat exists and overlaps with ISWs and GDEs.**
- [Section 1.2.2 Water Resources Monitoring and Management Programs (pp. 1-23 to 1-35)] Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater *and related surface conditions* (emphasis added). In order for this section to provide the appropriate context and help assure integration of GSP implementation with other ongoing regulatory programs, this section should describe the following:
  - *[The GSA's response noted that the GSP monitoring network meets the requirements of SGMA. Please see the prior comment.]* Monitoring activities and responsibilities by State, Federal and local agencies and jurisdictions related to aquatic resources and GDEs that could be affected by groundwater withdrawals should be discussed. Section 1.2.2.6 states that there are no agencies that do monitoring specific to surface-groundwater interconnection. While this may be technically correct insofar as it relates to hydrogeologic monitoring, it ignores ongoing monitoring programs related to the state of aquatic resources and GDEs that could be affected by groundwater withdrawals, and that are a direct indicator of potential undesirable results. For example, there are likely ongoing monitoring programs associated with

the protected lands listed in our comments to Section 1.3.1, and other open space or preserve areas that may be monitored by public, private or nonprofit entities. **A discussion of monitoring programs related to GDEs and ISWs should be included.**

  - *[Section 4.7 Data Gaps was updated to specifically include GDEs and ISWs. Many of the proposed monitoring wells are near streams and will be used to monitor and further analyze ISWs. Thank you for acknowledging the importance of incorporating GDEs and ISWs in the Data Gap section of the GSP and in proposed future monitoring.]* The lack of existing hydrologic monitoring of surface-groundwater interconnection is a significant data gap as it relates to classification and management of GDEs and should be identified as such and further discussed and addressed in the appropriate subsequent sections of the GSP.
  - *[Section 4.7 was updated to include a discussion of monitoring requirements for ISWs. Thank you for recognizing the importance of monitoring ISWs.]* Monitoring activities and responsibilities related to instream flow and water quality requirements under applicable Federal Energy Regulatory Commission licenses, Biological Opinions and other regulations or programs are relevant and should be identified. **Please include a discussion of water flow and quality monitoring requirements pertinent to ISWs.**

- [Section 1.2.3 Land Use Elements or Topic Categories of Applicable General Plans (pp. 1-35 to 1-40 and Appendix 1-E)]
  - *[The GSA's response stated that there will be additional coordination and refinement of GDE data gap areas as the GSP is refined. No changes to text made. Recognition of General Plan goals and policies in the GSP would help assure that GSP implementation is integrated with General Plan implementation and updates.]* This section should include a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals, rather than being limited to goals and policies directly related to groundwater resources alone. Section 1.3.1 correctly identifies environmental uses of groundwater as including "…species and habitat reliant on instream flows, as well as wetlands and GDEs," and yet Section 1.2.3 and Appendix 1-E do not identify any General Plan policies related to these resources. **Section 1.2.3 should identify if there are any Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin and if they are associated with critical, GDE and/or ISW habitats. Appendix 1-E should identify General Plan policies related to wetlands, riparian habitat, streams, aquatic habitat, and related threatened and endangered species. Section 1.2.3.2 should include a discussion of the relationship of GSP implementation to General Plan goals and policies related to GDEs and aquatic habitat; and also address how GSP implementation will coordinate with the goals of any HCPs or NCCPs.**

- [Section 1.2.3.4 Well Permitting (pp. 1-38 to 1-40)] **This section should include a discussion of the following:**
    - *[Section 1.2.3.4 has been updated to include Sacramento County well permitting requirements and additional information regarding notice of permit applications and well spacing requirements under Water Code (§ 10726.4(b)). Thank you for recognizing the importance of future well permitting and withdrawals on GDEs.].* Future well permitting must be coordinated with the GSP to assure achievement of the Plan's sustainability goals.
    - *[The GSA did not address this comment. No text changes were made.]* The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF v. SWRCB and Siskiyou County, No. C083239). The need for well permitting programs to comply with this requirement should be stated.
    - *[Section 1.2.3.4.3 has been updated to include language on procedures for applicants who are not exempt from the Stanislaus County Groundwater Ordinance. Thank you for protecting GDEs from undesirable results.]* Section 2.3.3.3 discusses potential exemptions from the Stanislaus County Groundwater Ordinance but does not mention the fact that applicants who are not exempt are required to provide substantial evidence that their proposed extraction will not result in undesirable results, including significant and unreasonable impacts to GDEs and surface waters.

Checklist Items 6 and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

- *[The GSA's response stated that the level of detail in the GSP is appropriate. No text changes were made.]* [Section 2.1.7 Geologic Cross Sections (pp. 2-35 to 2-37)] **Please clearly state whether localized perched aquifers are present in the basin. Include example near-surface cross section details that depict the conceptual understanding of shallow groundwater and stream interactions at different locations, including perched and regional aquifers**.
- *[The GSA's response stated, "Comment noted for follow up in next version of GSP." No text changes were made.]* [Section 2.1.8.2 Definable Bottom of the Basin (p. 2-42)] The Bottom of the Basin Boundary was defined by the base of freshwater, which was mapped 45 years ago and pumping since then has very likely resulted in shift in the isohaline contouring in the basin. Defining the bottom of the Subbasin based on geochemical properties is a suitable approach for defining the base of freshwater, however, as noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** This will prevent the possibility of extractors with wells deeper than the basin boundary from claiming exemption of SGMA due to their well residing outside the vertical extent of the basin boundary. Also, pumping saline groundwater and desalinating it will become increasingly economical under SGMA due to pumping restrictions in the basin.

- [Section 2.1.10 HCM Data Gaps (pp. 2-59 and 2-60)] The Hydrologic Conceptual Model identified several data gaps including the following for groundwater level data: *[The GSA's response was "Comment noted." Section 4.7 Data Gaps was updated to include further refinement of NCCAG areas removed through the GDE analysis. We appreciate acknowledgement of the importance of identifying and refining GDEs and understanding their characteristics.]*
    - Depth- or zone-specific water levels to assess vertical interconnection, including zones within the Principal Aquifer. **Nested monitoring wells would be helpful near surface water to show how pumping is impacting surface water flows and GDEs.**
    - Additional shallow groundwater data near surface waters and NCCAGs.
    - Additional groundwater level data in the east and northwest areas of the Subbasin.
    - Additional groundwater level data near the Mokelumne River to improve quantification and understanding of subsurface flows.

  Of these, the second data gap is the information that is most critical to identifying GDEs or potential GDEs and understanding their characteristics.

Checklist Items 8, 9 and 10 – Interconnected Surface Waters (23 CCR §354.16)

- *[The GSA's response refers to Master Response 2 – ISW, which addresses the comment. No changes to text were made.]* [Section 2.1.4.2 Major Hydraulic Features (pp. 2-9 to 2-14)] This section should discuss (or reference the sections discussing) the following:
    - Specific ISWs, including the extent of both gaining and losing reaches.
    - In-stream flow requirements in each of the interconnected rivers/streams including the amount, time of year when the flow minimum is specified, the duration, the freshwater fish species for which it applies, associated permits that set forth the requirements, and the regulating agency setting forth the compliance requirements.
    - Areas of critical habitat that exist within rivers and streams.
- *[Table 2-2 was updated by removing the statement in the comment.]* [Section 2.1.5 Geologic Formations and Stratigraphy (pp. 2-23 to 2-27)] Table 2-2 states that Holocene Stream Channel Deposits are generally not saturated except by the San Joaquin River. Based on the available data, it would be expected that the stream channel deposits associated with the other ISWs in the Subbasin would be saturated near those streams and rivers.
- *[The GSA's response refers to Master Response 2 – ISW. Section 2.1.9.2.2 was updated to refer readers to Section 2.2.6 for a discussion of historical groundwater-surface water interaction. Thank you for acknowledging the importance of historical groundwater-surface water interactions.]* [Section 2.1.9.2.2 Regional Historic Groundwater Flow and Surface Water Interaction (p. 2-52)] This section focuses on groundwater flow direction and defers further discussion of groundwater conditions to Section 2.2, which does not provide information on historical groundwater-surface water interaction. **This section should include a discussion of historic groundwater-surface water interaction.**

- Section 2.2.6 Interconnected Surface Water Systems (pp. 2-104 to 2-105)]
  - *[The GSA's response refers to Master Response 2 – ISW. Section 2.2.6 was updated to clarify that the ESJWRM historical calibration model results represent the best available information related to interconnectivity between surface water and groundwater, and to describe gaining and losing streams. The comment was incompletely addressed.]* The determination as to whether or not a stream reach is interconnected or disconnected was made based on whether modeling conducted for the GSP indicated that it is interconnected more than 25 percent of the time. Even if the stream is only connected 25% of the time, it is still connected, and that short period of connectivity may be during critical times for select species or provide a cooling or biogeochemical effect during a critical period. **Please describe the technical basis for selecting a 25 percent interconnection threshold, and how it will adequately protect the environmental beneficial uses of surface water in potentially interconnected surface waters from significant and unreasonable impacts related to groundwater extraction.**
  - *[The GSA's response refers to Master Response 2 – ISW, which addresses the comment. No changes to text were made. Data gaps related to ISWs have been updated in Section 4.7.]* Shallow groundwater monitoring data near surface waters and NCCAGs are identified as a data gap in Section 2.1.10, and the use of the Eastern San Joaquin Water Resources Model (ESJWRM) to determine the percentage of time that stream reaches are groundwater connected entails inherent uncertainty. The potential presence of shallow or perched aquifers near the rivers is not assessed or discussed in the GSP. Groundwater modeling conducted by the United States Geological Survey (USGS), DWR and others (e.g., JJ&A, 2018) has considered some river reaches shown as disconnected in Figure 2-66 (p. 2-105) to be groundwater-connected. No data or discussion is presented regarding the potential groundwater connection of other streams associated with significant wetland and riparian resources, including Pixley Slough, Mormon Slough, Littlejohns Creek, Bear Creek, Potter Creek, Duck Creek and Lone Tree Creek. As such, there is considerable uncertainty regarding the designation of interconnected and disconnected surface water resources in Figure 2-66. **The uncertainty regarding the groundwater interconnection of streams in the Subbasin should be identified as a data gap.**

Checklist Items 11 through 20 – Groundwater Dependent Ecosystems (23 CCR §354.16)

- *[Section 2.2.7 has been updated to state that SGMA requires the identification of GDEs and their inclusion as a beneficial user of water to be considered when developing sustainable management criteria. Thank you for including GDEs as a beneficial user of groundwater to be considered when developing sustainable management criteria.]* [Section 2.2.7 Groundwater-Dependent Ecosystems (p. 2-108)] This section includes the incorrect statement that SGMA does not require sustainable management criteria to be established for the management of GDEs. Section 1.3.1 of the GSP states that beneficial users of groundwater and ISWs include "environmental users of groundwater, including species and habitat reliant on instream flows, as well as wetlands and GDEs." Undesirable results under SGMA include chronic lowering of groundwater levels resulting in significant and unreasonable depletion of supply for beneficial groundwater users, *including* GDEs. Undesirable results also include depletion of ISWs resulting in significant and unreasonable adverse impacts on beneficial users of surface water, including wetlands and GDEs. **The incorrect statement that SGMA does not require the establishment of sustainable management criteria for GDEs should be removed.**

- *[The GSA's response refers to Master Response 1 – GDEs. Section 2.2.8 has been updated to better articulate the methodology used and describe the data gaps within the NCCAG dataset. Section 2.2.8 now refers to Section 4.7.4 for information regarding plans to fill GDE-related data gaps. We appreciate the efforts to reclassify GDEs and potential GDEs and the plans to identify existing GDEs that may have been incorrectly eliminated through the screening process as part of future updates to the GSP. We maintain that potential GDEs should be managed as beneficial users of groundwater under the current GSP until data gaps are reconciled and sufficient evidence exists to the contrary.]* [Section 2.2.8 Methodology for GDE Identification (pp. 2-108 to 2-114)] The GSP relies on the NCCAG database developed by TNC for the DWR to identify potential GDEs, and then provides a framework for removing most of these areas from further consideration. **It appears that the preliminary desktop analysis documented in the draft GSP resulted an excessive elimination of the NC dataset polygons mapped in the Eastern San Joaquin Subbasin.** In particular, the methods used to confirm whether or not polygons in the NC Dataset are connected to groundwater in the Eastern San Joaquin Subbasin are highly flawed. We have the following comments on the proposed approach:
    - The GSP takes the approach of removing NCCAGs with "access to alternate water supplies" from consideration as GDEs, and states that in order to be considered GDEs, "there must not be alternate water supplies". Alternate water supplies are assumed to include potential sources of surface water including managed wetlands, irrigated agricultural fields, perennial surface water sources, and other unspecified sources determined by stakeholders on a case-specific basis. This approach is inappropriate and deficient for several important reasons:
        - There is no hydrologic analysis or empirical data provided as a basis for the proposed buffer zones. The hydrologic connectivity between a GDE and a nearby alternative water source is highly dependent on local conditions and can vary seasonally and by year type. In the case of managed wetlands, no consideration is given to the nature of the wetland and surrounding area, the source and frequency of inundation, the soil types, and other features that would be needed to understand the hydrologic connectivity between the wetland and the surrounding area, or even whether the wetland itself it groundwater dependent for a portion of the year. Similarly, no information is given to the topography and hydrology surrounding irrigated agricultural fields, the soil types involved, irrigation practices, whether irrigation is likely to

be curtailed during dry years or during certain crop rotations, and other relevant factors. The hydrologic connectivity of perennial surface water sources cannot be assessed without specific knowledge of the water source, topography and soil conditions. In summary, the adequacy of generic buffer zones to assure GDE access to surface water is unsubstantiated.

  - No information is provided regarding the species residing in the GDEs, their sensitivity to groundwater level declines, or the extent of their reliance on groundwater vs. the proposed "alternate water supplies."
  - There is no evidence of consultation with the regulatory agencies responsible for the protection and management of these resources in the establishment of the proposed framework. It does not appear that any habitat assessments have been conducted.
  - Ecosystems often rely both on groundwater and surface water to meet their water needs (see Best Management Practice #3 in Attachment C of this letter). The availability of "alternate water supplies" to provide some portion of a GDE's water demand does not mean all of its water needs can be met through alternate supplies (i.e., without reliance on groundwater).
  - Groundwater pumping depletes ISWs under both gaining or losing conditions, and GDEs may rely on the interactions of surface water to meet their water requirements.

Simply put, the approach proposes to manage GDEs without consideration to understanding the nature and needs of the resource being managed. A strictly binary approach, designating all NCCAGs as either 100 percent reliant on groundwater or 100 percent reliant on alternate water supplies is inconsistent with the available science and is not supportable. **A scientific rationale for removing areas with access to assumed alternate water sources has not been provided. The deleted potential GDEs should be retained in the GSP and managed as potential GDEs. If further study and consultation with the appropriate regulatory agencies indicates that some areas would not be affected by groundwater withdrawals, consideration could be given to removing them at that time.**

- We have the following additional comments regarding the potential use of buffer zones to exclude NC-Dataset polygons from further consideration as GDEs:
  - **In the case of managed wetlands, the water sources used by the managed wetlands, the type of managed wetlands, the relationship of the wetlands to groundwater, and the wetland manager should be specified. In addition, these managed wetlands should be identified in Section 1.3.1.**
  - Please refer to Attachment C of this letter for best practices in using groundwater data to verify whether NCCAGs are GDEs. The GSP identifies monitoring data for shallow groundwater near ISWs as a data gap. **Please discuss what temporal and spatial data were**

used to identify "shallow groundwater," and identify any data gaps.

- A scientifically defensible rationale and data for applying the proposed buffer zones used to remove NCCAGs areas proximal to alternate water sources from consideration as GDEs has not been provided. In the absence of specific information regarding groundwater levels near these features, which is identified as a data gap in the GSP, it is possible that they are connected to a shallow groundwater table, at least seasonally. This is true of both gaining and losing reaches. Such a connection means they meet the definition of a GDE, regardless of whether the groundwater is replenished by a surface water source (see Best Management Practice #3 in Attachment C of this letter). In addition, the extent of groundwater reliance, and the ability of species to adapt to seasonal and long-term changes in hydrologic conditions, varies from species to species. We acknowledge that proximity to surface water sources and establishment of buffer zones may be an important consideration in GDE management; however, groundwater extraction can still result in drawdown near these areas, especially at the outer fringes of GDEs that are more vulnerable to drawdown. **Buffer zones, if used, must be supported by actual hydrologic and habitat assessment data. If such data and assessments are not available, the areas should not be deleted from consideration and management as GDEs. The need for supporting studies to validate the approach may be identified as a data gap and undertaken in the future.**
- The "stakeholder feedback" mechanism for removal of NCCAGs from consideration as GDEs is not explained or documented in the GSP. **Please provide details that support removing potential GDEs based on stakeholder feedback. Stakeholder feedback, in the absence of scientifically supportable data and/or agency consultation, may be insufficient to exclude areas from consideration as GDEs.**

- We have the following comments about the proposed use of a 30-foot depth to water criterion to exclude NC-Dataset polygons from further consideration as GDEs:
  - SGMA defines GDEs as "ecological communities and species that depend on *groundwater emerging from aquifers or on groundwater occurring near the ground surface*". **We recommend that depth to groundwater contour maps are used, where they can be reliably substantiated, to verify whether a connection to groundwater exists for polygons in the NC Dataset. This is preferable to relying on inferences based on the presence of surface water features in the Basin. However, it is important to note that where depth to water is uncertain in proximity to streams, a depth to water criterion for assessing which polygons are GDEs**

is inappropriate. Please refer to Appendix C of this letter for best practices for using groundwater data to verify a connection to groundwater.

- **Please provide more details on how depth to groundwater contour maps were developed:**
  - Are the wells used for interpolating depth to groundwater sufficiently close (<5km) to NC Dataset polygons to reflect local conditions relevant to ecosystems?
  - Are the wells used for interpolating depth to groundwater screened within the surficial unconfined aquifer and capable of measuring the true water table?
  - Is depth to groundwater contoured using groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape? This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[2] to estimate depth-to-groundwater contours across the landscape. This will provide much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make. It is better to assume that water surface elevations are constant in between wells, and then calculate depth to groundwater using a DEM of the land surface to contour depth to groundwater.
- The 30-foot depth to water criterion used to exclude riparian areas near streams east of the San Joaquin River from further consideration as GDEs is very broadly applied and poorly supported. Based on our understanding of the regional hydrogeology, we would expect riparian vegetation and wetlands near the major surface drainages to be connected to water tables associated with the regional aquifer system from a point where the streams exit the foothill uplands westward, except in areas of significant, pumping-induced drawdown. Shallow groundwater data near streams are identified as a significant data gap, and the available groundwater level data come from wells screened at a variety of depths. **The application of a 30-foot depth to water criterion is inadequately supported in light of the identified data gaps, and should not be used exclude potential GDEs from further consideration without additional study.**
- While depth to groundwater levels within 30 feet are generally accepted as being a proxy for confirming that polygons in the NC dataset are connected to groundwater, the variable needs of plant species and their dependence on seasonal and inter-annual

[2] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

groundwater level fluctuations should be considered when applying this criterion. The GSP cites a maximum rooting depth of 25 feet for oak trees as a basis for the 30-foot criterion, yet studies have found the roots of oaks can extend deeper than 70 feet to extract water from the capillary fringe immediately above the water table during the summer and fall, and that groundwater reserves provide a buffer to rapid changes in their hydroclimate, as long as groundwater reserves are not depleted by drought or human consumption.[3] **It is highly advised that seasonal and interannual fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one point in time or contoured with too few shallow monitoring wells can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs.** Based on a study we recently submitted to Frontiers in Environmental Science Journal, we've observed riparian forests along the Cosumnes River to experience a range in groundwater levels between 1.5 and 75 feet over seasonal and interannual timescales. Seasonal fluctuations in the regional water table can support perched groundwater near an intermittent river that seasonally runs dry due to large seasonal fluctuations in the regional water table. While perched groundwater itself cannot directly be managed due to its position in the vadose zone, the water table position within the regional aquifer (via pumping rate restrictions, restricted pumping at certain depths, restricted pumping around GDEs, well density rules) and its interactions with surface water (e.g., timing and duration) can be managed to prevent adverse impacts to ecosystems due to changes in groundwater quality and quantity under SGMA.

- Very little description is provided regarding the nature and function of the identified GDEs, their potential sensitivity to groundwater and surface water supply changes, their relative habitat value, or the current and historical groundwater conditions and variability near the GDEs. Given that monitoring of groundwater levels near ISWs has been identified as a data gap and limited resources are available to expand monitoring efforts in these areas, additional assessment would be helpful to identify and prioritize potential data gaps. **We recommend that a discussion regarding the nature and characteristics of the identified GDEs be included.**

Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)

- [Section 2.3.5 Water Budget Estimates (pp. 2-115 to 2-162)] The following items related to GDEs, wetlands and riparian areas should be clarified or considered:
  - *[The GSA's response indicated that the ESJWRM model does not have the level of detail to determine how much groundwater is consumed by riparian demand. No changes to GSP text made.]* "Riparian intake from streams" is

[3] *Miller and others. 2009. Groundwater Uptake by Woody Vegetation in a Semi-Arid Oak Savannah. Water Resources Research. Volume 46. November.*

identified as a stream system water budget component and is defined as the portion of riparian evapotranspiration (ET) met by streamflows. **Please include an explanation of the approach to determining the amount of riparian ET demand met by streamflow vs. groundwater evapotranspiration.**

  - *[The GSA's response indicated that groundwater outflow to evapotranspiration is simulated indirectly through stream-aquifer interaction and seepage of pumped groundwater in the ESJWRM model. No changes to text were made.]* Groundwater outflow to ET does not appear to be identified as a groundwater budget component (for example see Figure 2-79, p. 2-132). *[The GSA's response indicated that wetlands, GDEs, riparian vegetation, and native vegetation are included in the water budget as part of "Refuge, Native, and Riparian Evapotranspiration." No changes to text were made.]* In addition, the ET demand of natural vegetation does not appear to be considered in water supply and demand calculations (for example see Table 2-16, p. 2-134). **Since GDEs (including wetlands, riparian vegetation, phreatophytes and other communities) are recognized as beneficial users of groundwater in the Subbasin, it is appropriate to include them in these calculations.**

Checklist Items 23 and 25 – Sustainability Goal (23 CCR §354.24)

- *[The GSA's response indicated that the ESJGWA Board determined that the sustainability goal meets the requirements of SGMA. No changes to text were made.]* [Section 3.1 Sustainability Goal (p. 3-1)] The Sustainability Goal is defined as being "… to maintain an economically-viable groundwater resource for the beneficial use of the people of the Eastern San Joaquin Subbasin … ." **Since GDEs, are recognized as beneficial users of groundwater in the Subbasin, they should be mentioned in the Sustainability Goal.**

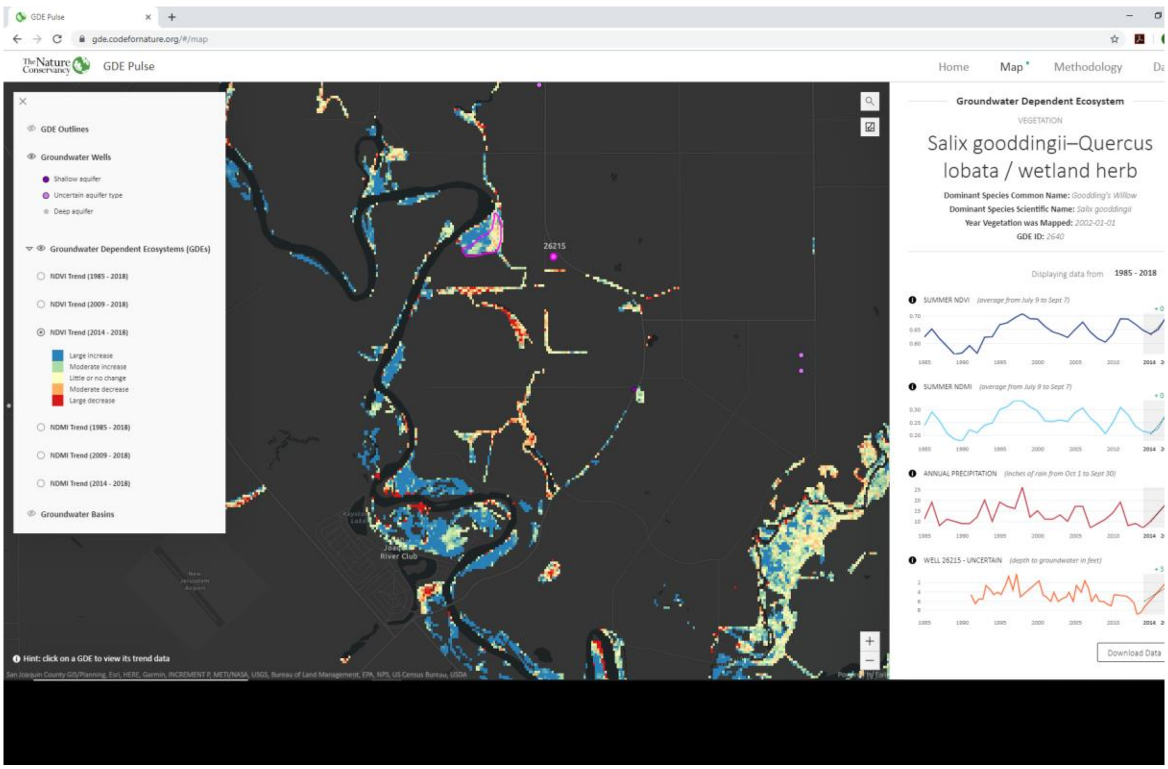
Checklist Item 26 – Measurable Objectives (23 CCR §354.30) and Checklist Items 30 to 33 – Undesirable Results (23 CCR §354.26)

- *[Section 3.2.1.1.1 was updated to include adverse impacts to environmental uses and users, including ISWs and GDEs as undesirable results for chronic lowering of groundwater levels. Thank you for recognizing the importance of environmental uses and users of groundwater.]* [Section 3.2.1.1.1 Description of Undesirable Results (for chronic lowering of groundwater levels (p. 3-3)] This section only describes undesirable results relating to human beneficial uses of groundwater and neglects environmental beneficial uses that could be adversely affected by chronic groundwater level decline. On page 3-5 in Section 3.2.1.2, impacts to GDEs are correctly identified as an undesirable result potentially associated with chronic groundwater level decline. **Please add "potential adverse impacts to GDEs" to the list of potential undesirable results presented in Section 3.2.1.1.1.**
- *[Section 3.2.3.1.1 was updated to include management of arsenic and nitrate as undesirable results for degraded water quality. Thank you for acknowledging the*

importance of overpumping as a potential source of arsenic and nitrate contamination to drinking water as an undesirable result.] [Section 3.2.3.1.1 Description of Undesirable Results (for degraded water quality (p. 3-11)] This section only describes undesirable results in terms of total dissolved solids concentrations and related impacts. **The section should be modified to state that overpumping and dewatering of aquitards has been identified as a potential source of elevated arsenic concentrations above drinking water standards in San Joaquin Valley aquifers.** The following is a link to a paper by Smith, Knight and Fendorf (2018) titled "Overpumping leads to California groundwater arsenic threat": (https://www.nature.com/articles/s41467-018-04475-3).

- *[The GSA's response stated that ESJGWA recognizes ISWs are a data gap and there is a need for future study and refinement. No text changes were made.]* [Section 3.2.6.1.1 Description of Undesirable Results (for ISWs (p. 3-20)] This section states that undesirable results related to surface water depletion were defined and evaluated only for major streams and rivers including the Calaveras River, Dry Creek, Mokelumne River, San Joaquin River, and Stanislaus River. The section goes on to state that many of the smaller creeks and streams are solely used for the conveyance of irrigation water and these systems have not been considered in the analysis of depletions. Contrary to these statements, surface water resources in these creeks support significant recognized aquatic habitat, wetlands and riparian zones that represent potential environmental beneficial uses and users of groundwater. A number of these streams are associated with designated protected lands. **The analysis for potential depletion of ISWs in Section 3.2.6 should include all beneficial users of surface water that could be affected by groundwater withdrawals, including environmental beneficial users along creeks, even if the creeks are interconnected less than 75% of the time.**
- *[The GSA's response stated that ESJGWA supports the definition of undesirable results and will continue to collect data to inform connectivity conditions in the Subbasin. No text changes were made.]* [Section 3.2.6.1.2 Identification of Undesirable Results (for ISWs (p. 3-21)] The section states that "undesirable results would occur if groundwater extractions depleted interconnected streams and there was not sufficient surface water to supply … fish and wildlife demands." This definition of undesirable results is overly narrow and recognizes only a limited subset of the environmental beneficial users of ISWs. A more complete definition would be that undesirable results would occur if groundwater extraction resulted in a depletion of surface water that caused significant impacts to aquatic species or wildlife, or degradation of GDEs. **Please expand the definition of undesirable results to include all of the environmental beneficial uses and users of ISWs, and expand the analysis in Section 3.2.6, as appropriate.**
- *[The GSA's response stated that language was added to reference beneficial uses and users in the Subbasin; however, no text changes were made.]* [Section 3.2.6.1.4 Potential Effects of Undesirable Results (for ISWs (p. 3-21)] The potential effects of undesirable results on environmental beneficial users are not described. **Please expand the section to describe the potential effects of undesirable results on all beneficial uses and users of ISWs, including environmental uses and users.**

- *[The GSA's response stated that ESJGWA would evaluate using the GDE Pulse Tool and other tools to monitor GDEs. No text changes were made.]* The GDE Pulse web application developed by The Nature Conservancy provides easy access to 35 years of satellite data to view trends of vegetation metrics, groundwater depth (where available), and precipitation data. This satellite imagery can be used to observe trends for NC dataset polygons within the Subbasin. Over the past 10 years (2009-2018), some NC dataset vegetation polygons have experienced adverse impacts to vegetation growth and moisture in the western portion of the Subbasin. An example screen shot from the GDE Pulse tool is presented below. **Please review these spatial patterns and, where possible, correlate them with water level trends. Any indications of adverse trends and any data gaps should be identified.**



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Checklist Items 27 to 29 – Minimum Thresholds (23 CCR §354.28).

- *[The GSA's response refers to Master Response 2 – ISW, which addresses the comment. No text changes were made.]* [Section 3.2.6.2 Minimum Thresholds (for ISWs (pp. 3-21 and 3-22)] The GSP proposes to use the Minimum Thresholds and Measurable Objectives associated with Chronic Decline in Groundwater Levels as a proxy for management of depletion of ISWs, and concludes that these criteria will be protective of the depletion of ISWs and prevent significant and unreasonable impacts to beneficial surface water uses and users. This conclusion is not adequately supported by data and/or consultation with the agencies that are responsible for the regulation of GDE habitats. We have the following comments:
    - The section states that current or historical issues associated with depletion of ISWs were not indicated to be significant and unreasonable based on

discussions at GWA Board, Advisory Committee, and Workgroup meetings and through input from GSA staff, and that it was therefore assumed that historical conditions are protective of beneficial uses. It does not appear that any consultation occurred with the Federal, State and local agencies responsible for management and regulation of environmental beneficial uses of ISWs, or with the private parties, agencies and NGOs involved in managing the protected lands listed in our response to Section 1.3.1. In addition, no reference is made to the review of supporting documents for General Plan Conservation or Land Use Elements, or to the review of environmental management studies and documents such as Biological Assessments, Biological Opinions, HCPs or other studies regarding the current and historical conditions of the beneficial uses being evaluated. **Please provide a more thorough explanation of the basis for the assumption that current and historical groundwater level conditions are protective of beneficial uses related to ISWs. Data gaps should be acknowledged.**

- The GDE Pulse web application developed by The Nature Conservancy provides easy access to 35 years of satellite data to view trends of vegetation metrics, groundwater depth (where available), and precipitation data. This satellite imagery can be used to observe trends for NC dataset polygons within the Subbasin. Over the past 10 years (2009-2018), some NC dataset vegetation polygons have experienced adverse impacts to vegetation growth and moisture in the western portion of the Subbasin. **Please review these spatial patterns and, where possible, correlate them with water level trends. Any indications of adverse trends and any data gaps should be identified.**
- The section discusses future use scenarios, associated groundwater level declines and ISW depletions on a broad level. The potential effects of these declines on environmental beneficial uses, including GDEs, are not discussed. In addition to discussion of potential adverse effects at a general level, a conclusion that significant adverse impacts are unlikely generally requires more site- and resource-specific analysis. **Please include a discussion of the potential for adverse effects of surface water depletions on environmental resources, as well as a reasoned analysis of the likelihood of their occurrence under future scenarios. The lack of site-specific data to draw conclusions about specific environmental beneficial users should be recognized as a data gap.**
- **Please expand the analysis of potential undesirable results to include all environmental beneficial uses and users, including those associated with more local streams and creeks.**
- The statement that an additional depletion of the surface water due to groundwater pumping of 50,000 acre-feet per year is not significant and unreasonable needs to be further analyzed. The conclusion is based on analyzing the estimated depletion as a percentage of total surface water discharge. The significance of such a depletion relative to specific beneficial uses and users will depend on its distribution throughout the surface water system. Even a modest amount of depletion may have a significant local

adverse effect. **The limitations of broad conclusions regarding basin-wide surface water flow depletions should be recognized and any data gaps identified.**

Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)

- *[The GSA's response refers to Master Response 2 – Interconnected Surface Water, which addresses the comment. No text changes were made.]* [Section 4.1 Monitoring Network for Chronic Groundwater Level Decline (pp. 4-1 to 4-8) and Section 4.6 Monitoring Network for Depletion of Interconnected Surface Water (p. 4-14)] The GSP proposes to use groundwater level monitoring for chronic groundwater level decline as a surrogate for monitoring the depletion of ISWs. We have the following comments.
    - The areas identified as potential GDEs in the GSP are located near the western boundary of the Subbasin. Only one of the representative monitoring wells appears to be located near those areas (Figure 4-1 on p. 4-5). Very few of the remaining monitoring wells are located near potential ISWs and GDEs. **Specific monitoring should be described to further evaluate, monitor, manage and protect areas with ISWs and GDEs.**
    - Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater ***and related surface conditions*** (emphasis added). Groundwater level monitoring alone may be insufficient to establish a linkage between groundwater extraction and potentially resulting impacts to environmental resources associated with GDEs and ISWs. The cause-effect relationship between groundwater levels and the biological responses that could result in significant and unreasonable impacts to ISWs and GDEs depends on a number of complicated factors, and this relationship is not characterized or discussed. As such, it is not possible to determine whether the proposed monitoring, minimum thresholds and measurable objectives are sufficiently protective to ensure significant and unreasonable impacts to GDEs and ISWs will be prevented. The GDE Pulse interactive mapping application provides an example of a linkage between groundwater level data and GDE health that could be used to incorporate remote sensing into an efficient and incisive monitoring program. **Please provide an explanation how groundwater levels will specifically be used to assess adverse impacts to GDEs and ISWs, and identify any data gaps and how they will be addressed.**
- [Section 4.7 Data Gaps (pp. 4-15 to 4-18)] Twelve new monitoring wells are proposed to measure groundwater levels and quality in critical areas where data are sparse. These include increased coverage near streams, Subbasin boundaries, and in the central area of groundwater depression. We have the following comments.
    - *[The GSA's response stated that the comment was noted for consideration as proposed monitoring well locations are finalized and for future updates to the monitoring network. No text changes were made.]* Locations should be prioritized near high value or sensitive resources that are vulnerable to significant and unreasonable impacts, such as near the protected lands identified in our comments on Section 1.3.1 or the GDEs identified in the

Subbasin. In addition to the major streams and rivers in the subbasin, impacts to smaller creeks and wetland areas should be considered, as these may be the most vulnerable resources. **Please discuss the results of a resource assessment or consultations with resource managers that demonstrates a sufficient number of wells is proposed to address data gaps near GDEs and ISWs, and that they are being sited where they will provide the most benefit. Alternatively, please outline the process by which this will be accomplished.**

  - *[The GSA's response stated that the impact of groundwater level declines to beneficial users as well as ISWs and GDEs will be considered in updates to the GSP and in annual reports. No text changes were made.]* **As discussed in our comments above, please address how the need to link and correlate groundwater level declines to biological responses, and significant and adverse impacts to GDEs and ISWs will be addressed.**
  - *[The GSA's response stated that the comment was noted for consideration as proposed monitoring well locations are finalized and future updates to the network (including installation of stream gages) are considered. No text changes were made.]* Well sites near ISWs should be selected at varying distances from streams and completed as vertically-nested clusters to capture the lateral and vertical gradients between the pumped depths in the aquifer system and the shallow groundwater aquifers that are in communication with ISWs or GDEs. **There is a need to enhance monitoring of stream flow and vertical groundwater gradients by installing more stream gauges and clustered/nested wells near streams, rivers or wetlands.** Ideally, co-locating stream gauges with clustered wells would enhance understanding about where ISWs exist in the basin and whether pumping is causing depletions of surface water or impacts on beneficial users of surface water and groundwater.
  - *[The GSA's response stated that ESJGWA is committed to resolving data gaps and may develop a program to reevaluate and fill data gaps, as discussed in Section 7.6.4. No text changes were made.]* Addressing data gaps is typically iterative and it is not reasonable to expect it will be a one-time process. **Please describe the process by which data gaps will be identified and addressed on an ongoing basis.**

- *[The GSA's response stated that surface water data including streamflow and water quality is already part of the Data Management System (DMS). No text changes were made.]* [Section 5.3 Data Included in the Management System (pp. 5-6 to 5-8)] Table 5.3 indicates that data regarding streamflow and GDEs is not currently included in the proposed Data Management System. Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater *and related surface conditions* (emphasis added). You cannot manage what you do not measure. **Please discuss which monitoring data for "related surface conditions" will be gathered and incorporated in the DMS to assess potential significant and unreasonable impacts to environmental beneficial uses and users**.

- *[Section 6.3 was updated and the statement regarding monitoring groundwater though the use of satellite imagery was removed.]* [Section 7.3.1 Monitoring (p. 7-6)] This section lists the key components involved in implementation of the monitoring network. Groundwater levels and monitoring will occur semi-annually, but no other information is given. Section 6.3 states that "additional management activities are discussed in Chapter 7: Plan Implementation", and would include monitoring groundwater use through use of satellite imagery. However, Chapter 7 does not discuss using imagery or any remote sensing, which is a great tool for monitoring ecosystem health of GDEs and ISWs. **Please clarify the potential use of imagery as a monitoring tool, and expand it to monitoring surface indicators of ISW and GDE ecosystem health.**
- *[The GSA's response stated that while there are no specific plans regarding the use of imagery as a monitoring tool, any publicly available tool, including GDE Pulse, will be evaluated for use in the GSP. No text changes were made.]* [Section 7.3.2.2 Basin Conditions (pp. 7-6 and 7-7)] This section describes what current groundwater conditions and monitoring results will be included in the annual monitoring report. **Please specifically address ecosystem health of GDEs and ISWs as a surface indictor to subsurface conditions.** This can be done using GDE Pulse, remote sensing, imagery or other feasible methods.

Checklist Items 50 and 51 – Project and Management Actions (23 CCR §354.44)

- *[The GSA's response refers to Master Response 5 – Projects but the master response does not specifically address this comment. No text changes were made.]* [Section 6.2.1 Project Identification (p. 6-1)] The Subbasin includes many GDEs and ISWs which represent beneficial uses and users of groundwater, and which include potentially sensitive resources and protected lands. Environmental resource protection needs should be considered in establishing project priorities. In addition, consistent with existing grant and funding guidelines for SGMA-related work, priority should be given to multi-benefit projects that can address water quantity as well as providing environmental benefits or benefits to disadvantaged communities. **Please include environmental benefits and multiple benefits as criteria for assessing project priorities.**
- *[The GSA's response stated that expected project benefits are included in the text in Chapter 6. No text or table changes were made.]* Table 6-1 (pp. 6-2 to 6-7) lists potential projects and the Measurable Objective that is expected to benefit. Only water level benefits are listed, but maintenance or recovery of groundwater levels, or construction of recharge facilities, also will have environmental benefits in many cases. From the table, it is not possible to distinguish the full range of project benefits or how the projects will be prioritized. **It would be advantageous to demonstrate multiple benefits from a funding and prioritization perspective.**
- *[The GSA's response stated that project proposed by individual GSAs will be implemented at the GSA level. No text or table changes were made.]* [Sections 6.2.4 Planned Projects and 6.2.5 Potential Projects (pp. 6-8 to 6-33)]
    - **For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.**

- If ISWs will not be adequately protected by those listed, **please include and describe additional management actions and projects targeted for protecting ISWs.**
- Recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such facilities have been incorporated into local HCPs, more fully recognizing the value of the habitat that they provide and the species they support. For projects that will be constructing recharge ponds, **please consider identifying if there will be habitat value incorporated into the design and how the recharge ponds will be managed to benefit environmental users.**
- Specific examples of how project descriptions may be refined to incorporate environmental benefits include the following:
  - Project 21: Winery Recycled Water will recycle winery wastewater and reuse it for irrigation and in-lieu recharge, or the water will be put into ponds. **Please consider identifying what proportion of water will be put into ponds for direct recharge that could also provide a benefit for wildlife and aquatic species.**
  - Project 23: SSJID Stormwater Reuse will capture stormwater for reuse and recharge. Project 18: Farmington Dam Repurpose Project proposes to more than double storage in Farmington Basin for water supply. **Please consider assessing ways in which these projects could also provide enhanced wildlife and aquatic species benefits.**
  - For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

- *[The GSA's response refers to Master Response 5 – Projects but the master response does not specifically address this comment. No text changes were made.]* [Section 6.3 Management Actions (p. 6-37)] This section lists only administrative actions the GSA will undertake to implement the GSP, and does not identify the management actions to be taken if to assure SGMA compliance if monitoring data indicate that measurable objectives or interim milestones are not being achieved. An adaptive management approach, where monitoring data are used to assess results and inform refinement of the management approach is typically specified. **Please identify what management actions will be taken if monitoring data indicate that Measurable Objectives or Interim Milestones are not being achieved, or undesirable results are imminent.**

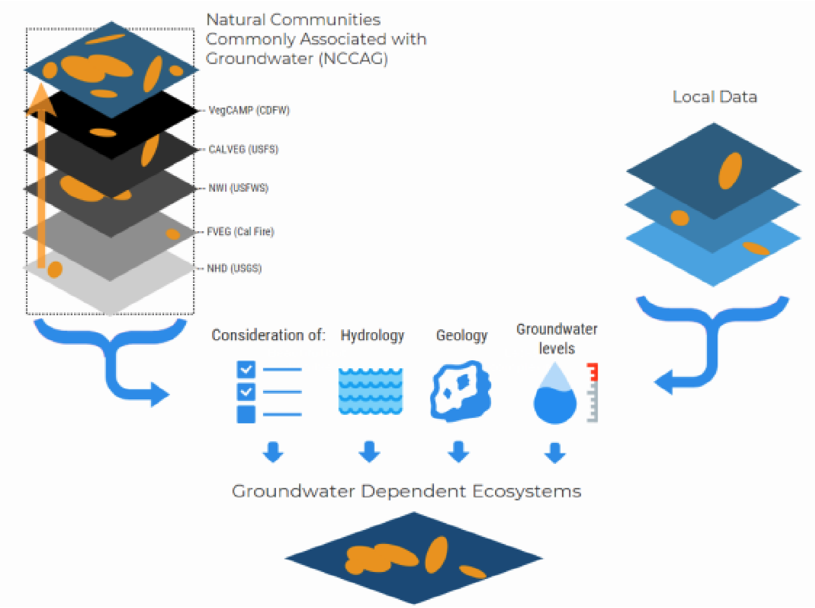
Attachment C

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[4] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[5]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[4] *NC Dataset Online Viewer:* *https://gis.water.ca.gov/app/NCDatasetViewer/*

[5] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[6]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[7] on the Groundwater Resource Hub[8], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[6] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[7] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[8] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

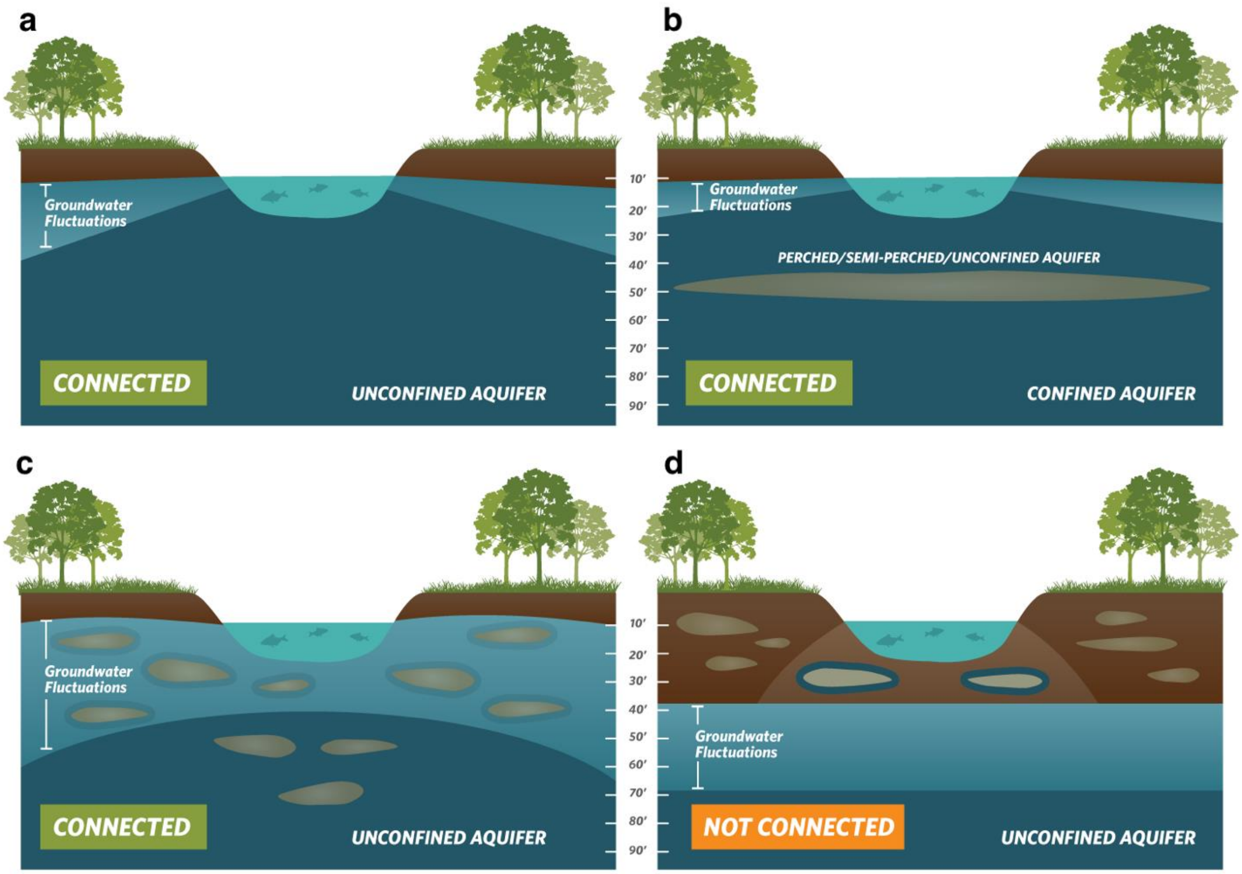

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[9] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[10] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[11] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[12]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network (see Best Practice #6).

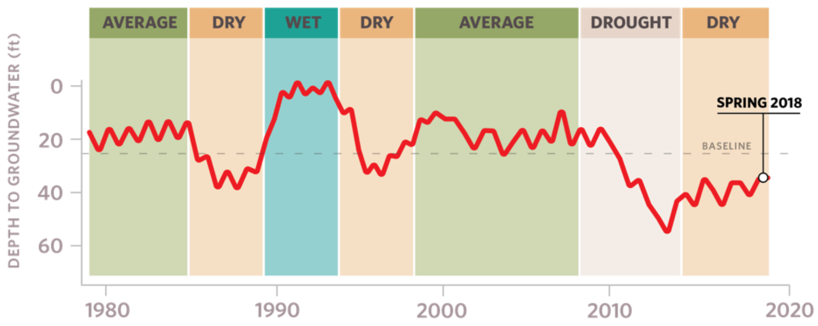

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[9] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[10] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[11] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[12] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[13], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

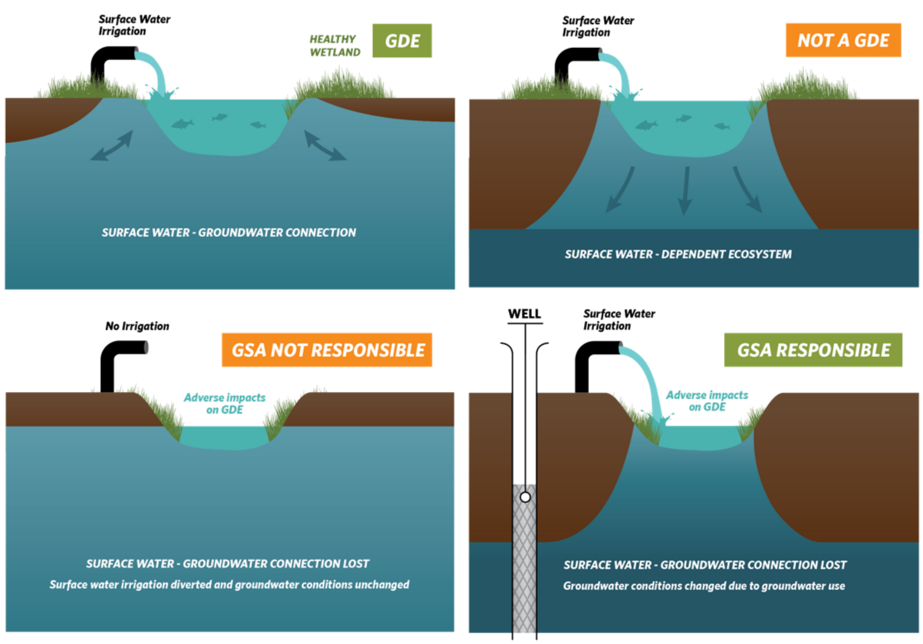

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[13] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

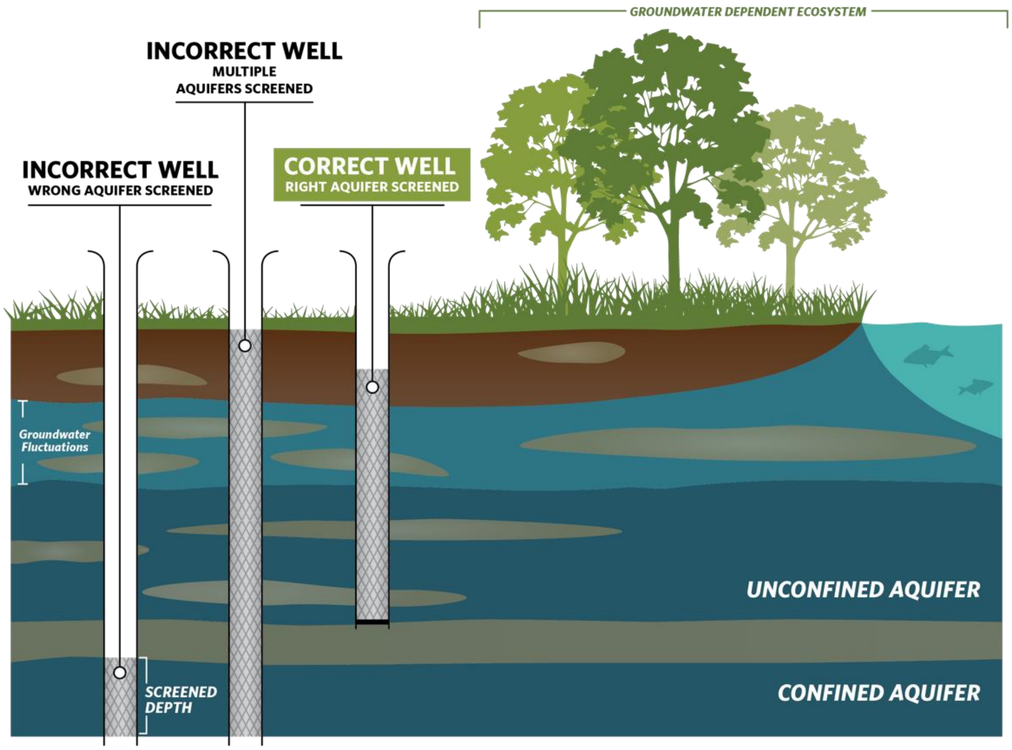

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[14] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

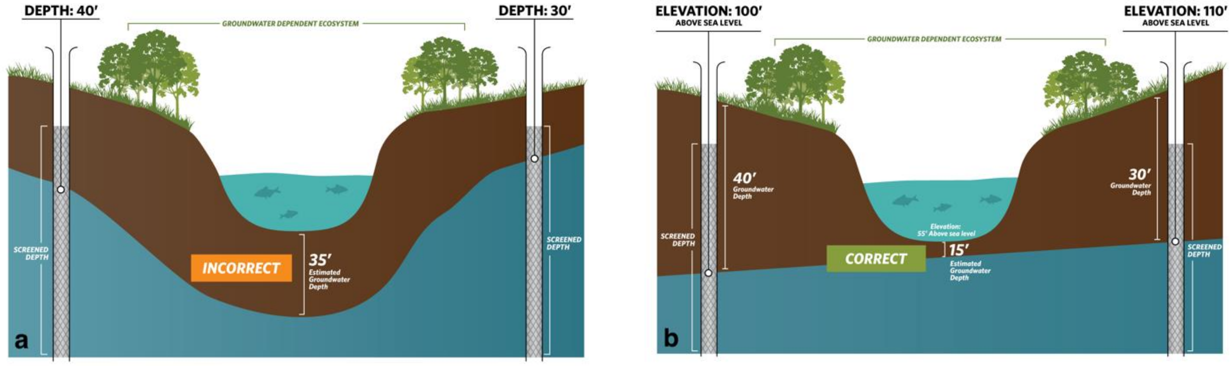

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

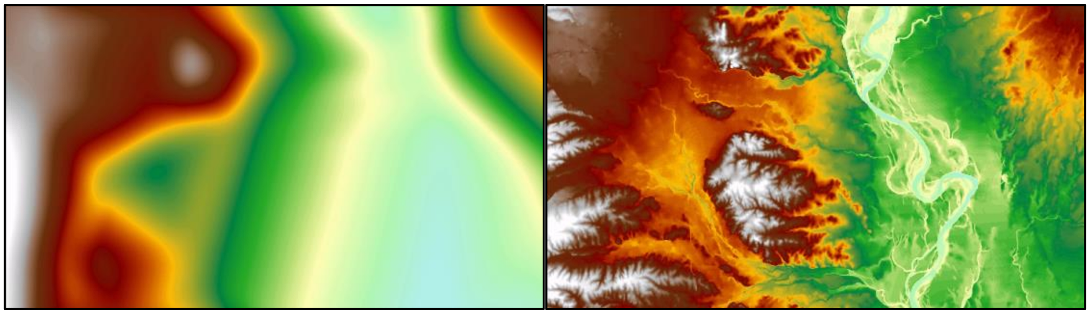

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[14] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment D

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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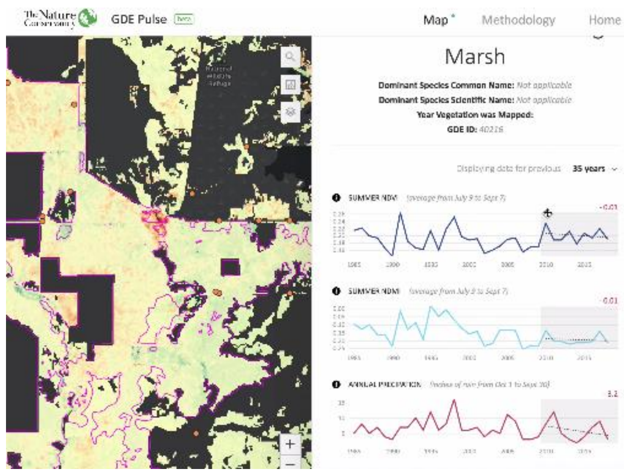
Visit https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[15]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[16]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

[15] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[16] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment E

The GSA Response to TNC Comments on the Draft GSP is attached to the SGMA portal as attachment 2 of 2.

Attachment F

Mapping Likely Interconnected Surface Water
The Nature Conservancy, California, May 2020

Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, ISW is defined as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:
The groundwater elevation data, available for Spring 2011-2012, and Spring and Fall 2013-2018, comes from the California Department of Water Resources (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). These data are represented as continuous raster layers that approximates "feet above or below mean sea level" based on groundwater well measurements. According to the documentation online, groundwater level measurements were selected based on measurement date and well construction information (where available) and are intended to approximate the groundwater levels in the unconfined to uppermost semi-confined aquifers. Each of the raster layer has a different extent, but all of them are limited to the Central Valley. To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

The map splits groundwater depth into four categories:

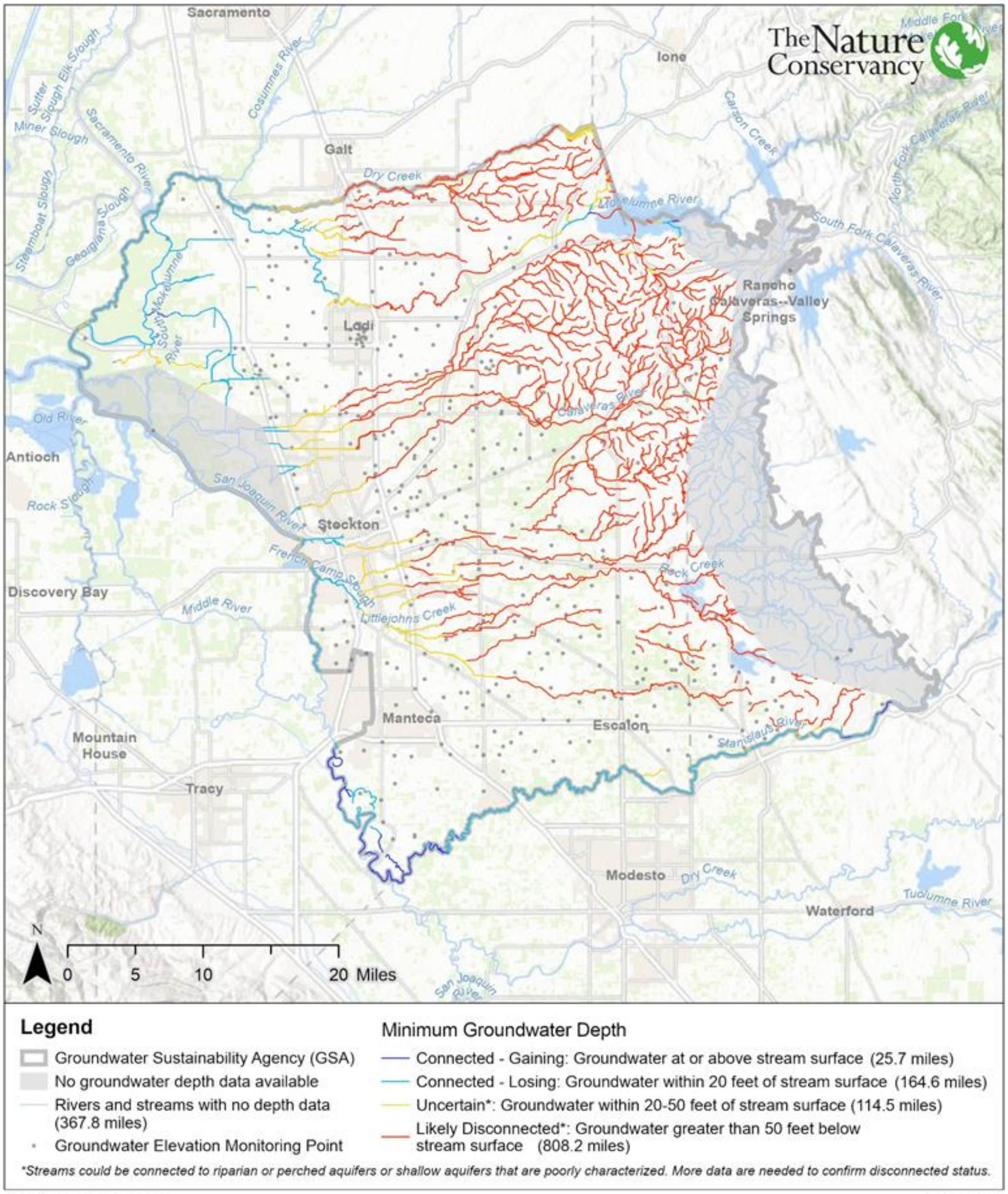
- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.
- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream

height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.

Interconnected Surface Water: Minimum Groundwater Depth (2011-2018)

Eastern San Joaquin Groundwater Subbasin GSP



5-022.01_EasternSanJoaquin

Data Sources:
CA Dept. of Water Resources Groundwater Elevation Data, gis.water.ca.gov/app/gicima/
NHD Plus V2 Streams, nhdplus.com/NHDPlus/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[17]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[18]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[19] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[17] https://www.ncbi.nlm.nih.gov/pubmed/12753220
[18] Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009
[19] Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015

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GroundwaterResourceHub.org

May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Fresno County Management Areas A & B Groundwater Sustainability Plan (GSP), Delta-Mendota Subbasin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the County of Fresno Groundwater Sustainability Agency's (GSA's) Fresno County Management Areas A & B (FCMA) Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing *sustainable* groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be incomplete in addressing environmental beneficial uses and users.

While the GSP addressed environmental beneficial users in some respects, our review finds that portions of the GSP should be remedied before being approved. Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some case, it may be difficult to address within 180 days. In these cases, we strongly recommend that the Department, at a minimum, set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides the GSA's response to TNC's comments on the Draft GSP. Attachment G provides a map and method summary of possible ISWs.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We are disappointed to see the feedback that we provided on the draft GSP has been largely ignored in the final plan, as only 7 out of 59 of our comments on the draft GSP were addressed. This indicates poor engagement of environmental beneficial users, which undermines the intent of SGMA to ensure that sustainability be defined locally with the participation of all users. Based on our experience, the GSP did not "adequately respond(d) to comments that raise credible technical or policy issues with the Plan" (23 CCR §355.4(b)(10)).

TNC recommendation: We strongly recommend that the GSA prioritize stakeholder engagement through improvements to the stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters – We are pleased to see that the GSP identified and mapped ISWs. The GSP identifies Fresno Slough, which runs through Management Area B, as the only surface water system connected to groundwater in the FCMA GSP. Seepage rates have been developed and are controlled by water levels in the slough and fine-grained sediments at the bottom of the Mendota Pool. Monitoring of ISWs as described in the Plan utilizes monitoring data from San Luis Delta-Mendota Water Authority (SLDMWA); the stage of the Mendota Pool is monitored daily and water levels in the Mendota Pool have historically been stable. The GSP also identified environmental users of surface water, which is required to assess whether surface water depletions caused by groundwater use are having an adverse impact (23 CCR §354.28(c)(6)).

Map and Assessment of potential ISWs:
By combining multiple years and seasons of groundwater depth data, The Nature Conservancy has determined that within the FCMA GSP, 2.9 river miles are interconnected (losing), 9.9 miles may be interconnected but are uncertain based on the groundwater depths. Attachment G contains a one-page method summary and a GSP-specific map of ISWs. The interconnected surface water displayed on the map is based on the minimum groundwater depth estimated by the California Department of Water Resources between 2011 and 2018.

Note: In most cases, the groundwater depth data used to generate the ISW map does not include perched aquifers. As such, some streams marked as disconnected could in actuality, be connected.

Groundwater Dependent Ecosystems – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 4,640 acres of potential GDEs occur in the GSA boundary. TNC developed the *Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs*[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

[1] Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

While we were pleased to see that the GSP took some steps to identify and map GDEs, we found that some GDEs were improperly disregarded. We recommend that the GSP remedy the omissions by following our recommendations in Attachment B. The GSP should also revisit all components of the plan where GDEs, as a beneficial user, must be considered, especially in determining undesirable results, minimum thresholds and measurable objectives. Our review found that NC Dataset polygons were improperly removed from the GDE map as follows:

- GDEs were rejected on the basis that groundwater levels were greater than 30 feet at a single point in time. This is approach is inconsistent with the best available science because groundwater levels fluctuate over seasons and between years due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Justifying the removal of NC dataset polygons solely based on this criterion does not acknowledge that groundwater levels temporally vary and the fact that many plant species within GDEs can access groundwater depths beyond 30 feet or have adapted water stress strategies to deal with intermittent periods of deep groundwater levels. Using this methodology disregards groundwater fluctuations and can exclude ecosystems that depend on groundwater.

- Wetland GDEs were removed in areas that were not saturated on a continual basis. This approach is inconsistent with the best available science because GDEs can rely on multiple water sources simultaneously and at different temporal or spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow). Justifying the removal based on the level of inundation on aerial photography does not acknowledge multiple sources and different temporal or spatial scales. Using the level of inundation disregards the presence of multiple water sources and could result in Exclusion of wetlands that are groundwater dependent.

TNC recommendation: Request that the GSA use groundwater levels that represent interannual and inter-seasonal variability and utilize additional information provided in our guidance document (Attachment D) to identify and consider GDEs throughout the GSP. Specifically, the GSA should use the Digital Elevation Model (DEM) when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment D. If insufficient data are available to describe groundwater conditions within or near GDEs, those GDEs should be included in the GSP until data gaps are reconciled in the monitoring network.

Water Budget – We would like to commend the FCMA GSP for including the groundwater demands of native vegetation, which includes riparian vegetation, in the historical, current and projected water budgets.

Sustainable Management Criteria – The GSP took steps towards including environmental beneficial users of groundwater and interconnected surface water, however, the Sustainable Management Criteria should be improved to describe potential effects of undesirable results on environmental users of groundwater and confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to beneficial users of surface waters, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)) as these environmental users could be left unprotected by the GSP. Undesirable Result #1, #2, #4, and #5 do not specify impacts to GDEs (Undesirable Result #3 seawater intrusion is not applicable because the subbasin is not a coastal basin). Undesirable Result #6 for depletion of interconnected surface waters states that impacts to GDEs will be further evaluated as more data is collected and data gaps are filled.

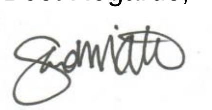
TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

The Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. As a result, the monitoring network does not adequately characterize the interaction of GDEs and other environmental beneficial users with surface water and groundwater. Shallow groundwater data are lacking from the Mendota Wildlife Area of Management Area B south of Whitesbridge Road. Potential GDEs are located along surface water bodies where no shallow groundwater monitoring is proposed, leaving recognized data gaps unfilled. Therefore, GDEs are not being addressed in the monitoring network in the GSP.

TNC recommendation: (1) reconcile data gaps in the monitoring network, particularly in the Mendota Wildlife Area, by evaluating how the gathered data will be used to verify possible GDEs as groundwater dependent; (2) discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions; and (3) add ecological monitoring to assess potential impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but *sustainable* groundwater management that considers the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,



Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at:
https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Fresno County Management Areas A & B Groundwater Sustainability Plan

The Fresno County Management Areas A & B GSP, adopted January 7, 2020 as Resolution No. 20-013, was reviewed by TNC. TNC submitted comments on the Public Draft GSP on December 6, 2019. Responses to comments on the public draft were included as Section 2.5.3 of the GSP. The GSA response to our draft comment letter is provided in Attachment F of this letter. We reviewed the responses to comments and the text of the Final GSP to determine if changes were made to the Final GSP text that addressed TNC's previously submitted comments. This attachment lists our original comments on the complete Public Draft GSP, as submitted to the County of Fresno Groundwater Sustainability Agency (GSA) during the public comment period, and states whether or not they were addressed in the Final GSP [as green text in brackets]. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

[Section 2.5.1 Description of Beneficial Uses and Users of Groundwater (p.16)]

- *[Thank you for acknowledging beneficial uses and users of groundwater in the GSP. Section 2.5.1 has been updated and identifies beneficial users. Environmental users are listed as the MWA, the Alkali Ecological Reserve, and other GDEs present in the GSP area.]* Beneficial uses are listed as agricultural, domestic and environmental. There are no municipal beneficial users in FCMA. The Fresno County A & B GSP notes that the CDFW owns and operates the MWA. CDFW was contacted regarding the development of the GSP and to obtain access to construct new monitoring wells. There are no further descriptions of the environmental uses until GSP Section 3.1.7, Surface Water Features (p. 31), which describes the Mendota Pool, Fresno Slough, and the canal system near the MWA, but does not discuss the wildlife species that inhabit the areas. **Besides the MWA, please identify whether or not the following beneficial uses and users of groundwater in the Subbasin are present: Protected Lands, including refuges, conservation areas, and recreational areas; and Public Trust Uses, including wildlife, aquatic habitat, fisheries, and recreation.**
- *[Section 2.5.1 has been updated and identifies environmental users. Thank you for recognizing environmental users in the GSP.]* The types and locations of environmental uses, species and habitats supported, instream flow requirements, and other designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in FCMA should be specified. **To identify environmental users, please refer to the following:**
    - The NC Dataset (https://gis.water.ca.gov/app/NCDatasetViewer/) which identifies potential presence of groundwater dependent ecosystems.

- The list of freshwater species located in the Delta-Mendota Subbasin in Attachment C of this letter. Please take particular note of the species with protected status.
- CDFW's California Natural Diversity Database (CNDDB) - https://www.wildlife.ca.gov/Data/CNDDB
- USFWS's IPAC report for the FCMA - https://ecos.fws.gov/ipac/

Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8).

[Section 2.2 Water Resources Monitoring and Management Programs (p. 12)]

- *[The GSA's response states that "existing streamflow monitoring has not considered the protection of interconnected surface waters" which negatively impacts ISWs because they are not being monitored. As required under SGMA (23 CCR §354.28(c)(6)), identifying environmental users of surface water, gaining and losing reaches, and spatial and temporal variations in streamflow is necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on ISWs and GDEs, and would serve to protect ISWs and GDEs. No changes to GSP text made.]* The GSP states (p. 12): "The [Mendota Pool Group] MPG Monitoring Program was established in 1999, and over the past two decades of annual reporting has created an extensive record of groundwater, surface water, and geologic data. Some of the MPG monitoring data applicable to the FCMA GSP effort will be used to develop and implement the GSP for FCMA. Existing monitoring locations (e.g., wells, extensometers, surface water sampling locations) will be incorporated, as necessary, into the Subbasin and FCMA monitoring network." **Please explain the relationship of existing stream flow monitoring to the protection of ISWs and GDEs.**

[Section 2.3.1 Fresno County General Plan (p. 12-13)]

- *[The GSA's response states that the general plan is being updated in 2020 and future updates to the GSP will consider the goals of the updated general plan. No changes to the GSP text made.]* The Fresno County General Plan was adopted in 2000, prior to the formation of the GSA. FCMA is designated as "Agricultural" or "Open Space", which refers to the MWA. There are limits to the number of residential units that can be built in those areas. In this section, **please include a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals. Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs.**
- *[The GSA's response states that there are no HCPs or NCCPs in the FCMA. No changes to the GSP text made.]* This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin and if they are associated with critical, GDE or ISW habitats. **Please identify any**

relevant HCPs and NCCPs within the Subbasin, and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.

- *[The GSA's response states that GSP regulations do not require the identification of individual species and that the identification of GDEs accounts for all species that may occupy a GDE. Because critical species and their habitats have not been identified, these aquatic species are not being managed or protected by the GSP. The GSP would benefit from the inclusion of a discussion regarding the management of critical habitat. No changes to the GSP text made.]* Please refer to the Critical Species Lookbook[2] to review and discuss the potential groundwater reliance of critical species in the basin. **Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.**

[Section 2.4.4 Well Construction, Well Destruction, Abandonment (p. 13)]

- *[The GSA's response was "Comment noted." No changes to the GSP text made.]* The County of Fresno has the authority to require permits for well abandonment, construction of new wells, reconstruction, repair, and deepening existing wells. Well permitting is currently handled by the Fresno County Environmental Health Department. The DWR well construction/destruction standards are followed (Bulletin 74-81 and 74-90). **Please include a discussion of how future well permitting will be coordinated with the GSP to assure achievement of the Plan's sustainability goals.**
- *[The GSA's response was "Comment noted." No changes to the GSP text made.]* The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF vs. SWRCB and Siskiyou County, No. C083239). **Compliance of well permitting programs with this requirement should be stated in the GSP.**

Checklist Items 5, 6, and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 3.1.2 Local Geologic Setting (p. 25-28)]

- *[The GSA's response states that the GSP regulations do not require development of a cross section to depict the interaction of shallow groundwater with surface water features and does not address our comment. The GSP would benefit from the inclusion of a conceptual diagram that show the interaction of shallow groundwater with any potential GDEs and ISWs. No changes to the GSP text made.]* The basin-wide cross sections modified from Miller et al. (1971) (Figures 3-4 through 3-5) are regional, and do not include a graphical representation of the manner in which shallow groundwater may interact with ISWs or GDEs that would allow the reader to understand this topic. **Please include an example near-surface cross section that depicts the conceptual understanding of the interaction of shallow groundwater with the Fresno Slough, as well as any potential GDEs and ISWs**.

[2] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

[Section 3.1.6 Definable Bottom of Basin (p. 31)]

- *[The GSA's response states that the base of freshwater is well below the Corcoran Clay; however, there are no known wells in the FCMA screened below the clay, therefore the base of freshwater is based on regional well data and is not well defined. The GSP would benefit from the inclusion of groundwater extraction well depth data for the determination of the basin bottom. No changes to the GSP text made.]* In the FCMA, the base of the usable aquifer corresponds with the base of freshwater, generally defined as groundwater with total dissolved solids (TDS) of 2,000 mg/L (Page, 1973), consistent with other GSAs in the Delta-Mendota Subbasin. As noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** Properly defining the bottom of the basin will prevent the possibility of extractors with wells deeper than the basin boundary from claiming exemption from SGMA due to their well residing outside the vertical extent of the basin boundary.

[Section 3.1.3 Principal Aquifers and Aquitards (p. 28-30)]

- *[The GSA's response states that that the shallow zone has not been identified as a principal aquifer, but part of the Upper Aquifer which is a principal aquifer; however, no changes to the GSP text were made. The GSP would benefit from a clarification that the Upper Aquifer consists of the upper zone and the shallow zone from DWR Bulletin 118.]* The GSP states (p. 28): "DWR Bulletin 118 defines three water-bearing zones within the Subbasin. These include the lower zone (defined as the Lower Aquifer), which contains confined fresh water in the lower section of the Tulare Formation, an upper zone (defined as the Upper Aquifer) which contains confined, semi-confined, and unconfined water in the upper section of the Tulare Formation and younger deposits, and a Shallow Zone which contains unconfined water within about 25 feet of the land surface (Davis 1959). This GSP defines two principal aquifers. The Lower Aquifer which is defined as the lower zone in Bulletin 118, and the Upper Aquifer which consists of the upper zone." **Please clarify in this section that the Upper Aquifer as referred to in this GSP consists of the upper zone and the shallow zone from DWR Bulletin 118, if that is the intended meaning. This seems to be confirmed in the following Section of the GSP (3.1.3.1 Upper Aquifer) but should be clearly stated in the first paragraph of Section 3.1.3 Principal Aquifers and Aquitards.**

[Section 3.1.7 Surface Water Features (p. 31-32]

- *[Section 3.1.7 has been updated and states that there is one potential wetland along the Fresno Slough and the rest of the wetlands are mapped as riverine. Thank you for recognizing the presence of wetlands along the Fresno Slough.]* The GSP states (p. 32): "There are not any naturally occurring springs, seeps, or wetlands in FCMA or within the model domain." This sentence seems inconsistent with other parts of the GSP, particularly section 3.2.7 Identification of Groundwater Dependent Ecosystems, which refers to wetland GDEs on the banks of the Fresno Slough. **Please revise the text to clarify the presence of wetlands, distinguishing between natural and managed wetlands if necessary.**

Checklist Items 8, 9, and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)

[Section 3.2.6 Interconnected Surface Water Systems (p. 41)]

- *[The GSA's response was "Comment noted." No changes to the GSP text made.]* The GSP confirms that the Fresno Slough is an ISW. The GSP states (p. 41): "Water levels in the Slough are controlled by the SJREC and USBR in coordination with the San Luis Delta-Mendota Water Authority (SLDMWA)." Table 3-2 provides seepage rates from the Fresno Slough to the Upper Aquifer. **Please state whether seepage rates have been quantified by reach or season and present these if known, based on the cited source [LSCE and KDSA (2000)] or other sources.**

Checklist Items 11 to 15, Identifying and Mapping GDEs (23 CCR §354.16)

[Section 3.2.7 Identification of Groundwater Dependent Ecosystems (p. 41-43)]

- *[The definition of GDEs in Section 3.2.7 has been updated. Thank you for acknowledging GDEs and including the definition of GDEs from the GSP regulations in the GSP.]* The GSP states (p. 41): "GSP regulation (§ 351 m) defines GDEs as ecological communities of species that depend on groundwater emerging from aquifers or on groundwater occurring within 30 feet of the ground surface." However, the exact text of the regulation is: "Groundwater dependent ecosystem refers to ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface." **Please revise the GSP text to correctly reflect the text of the regulation.**
- *[The GSA's response was "Comment noted." No changes to GSP text made.]* The GSP states (p. 42): "For the vegetation data set, GDEs were first evaluated by using depth to water (DTW) measurements from Spring 2015 from Shallow Zone wells (screened above the A-Clay). Based on a water level threshold of 30 ft below ground surface (ft bgs), areas with water levels greater than 30 ft bgs were removed as containing GDEs, and areas with water levels shallower than the threshold were kept as GDEs." We have the following comments on this methodology:
    - **Please provide more details on how the depth to groundwater contours shown on Figure 3-37 were developed**:
        - Are the wells used for interpolating depth to groundwater sufficiently close (<5km) to NC Dataset polygons to reflect local conditions relevant to ecosystems?
        - Is depth to groundwater contoured using groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape? This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide much

more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make. It is better to assume that water surface elevations are constant in between wells, and then calculate depth to groundwater using a DEM of the land surface to contour depth to groundwater.

- *[The GSA's response was "Comment noted." No changes to GSP text made.]* Spring 2015 is after the SGMA benchmark date of January 1, 2015. **Please ensure that groundwater condition data prior to the SGMA benchmark date of January 1, 2015 is included in the analysis.**
- *[The GSA's response was "Comment noted." No changes to GSP text made.]* It is highly advised that seasonal and interannual groundwater fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one point in time (e.g., Spring 2015) can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. **We highly recommend using depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network**.
- *[The GSA's response states that GSP regulations do not require identification of potential vegetation. TNC's comment concerning the 30-foot depth criteria for removing GDEs was not addressed. GDEs were removed based on groundwater levels that were greater than 30 feet at <u>a single point in time</u>. This approach is technically incorrect because groundwater levels fluctuate over seasonal and interannual time scales due to California's Mediterranean climate and intensifying flood and drought events due to climate change. TNC recommends that the GSP use groundwater levels that represent interannual and inter-seasonal variability to identify GDEs in the GSP. No changes to GSP text made.]* **Please provide rationale for the 30-foot criteria cited in the text.** In TNC's GDE Guidance, the depth criteria of 30 feet is presented as a criterion for inclusion, not a standalone criterion for exclusion. In other words, if groundwater is within 30 feet of the ground surface, then a GDE can be identified. If it is not, then further analysis must be conducted (see Appendix III of the GDE Guidance, Worksheet 1, for other indicators of GDEs). **Please indicate what vegetation is present in the possible GDEs. The actual rooting depth of vegetation growing in the area should be a consideration, and this will vary by species dominance and habitats present.** For example, some phreatophytes can

root to 120-feet deep in more arid and drought-stressed environments. Furthermore, rooting depths are likely to spatially vary based on the local hydrologic conditions available to the plant. Maximum rooting depths do not take capillary action into consideration, which will vary with soil type and is an important consideration since woody phreatophytes generally do not prefer to have their roots submerged in groundwater for extended periods of time, and hence can access groundwater at deeper depths.

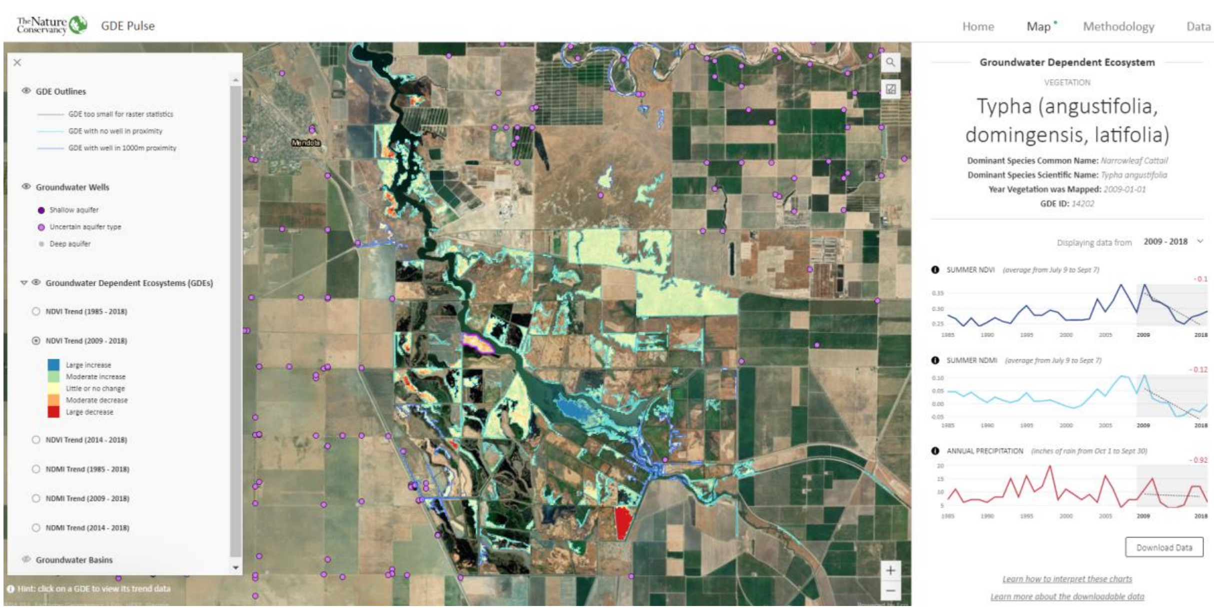
- *[The GSA's response incorrectly assumes that Wetland GDEs cannot exist where the depth to groundwater is greater than 30 feet. The text in Section 3.2.7.1 was revised to state that wetland GDEs along the banks of the Fresno Slough were removed because based on historic imagery they are only saturated during wet years and contain minimal vegetation. The use of aerial imagery to characterize groundwater conditions around Wetland GDEs is not scientifically robust.]* The GSP states (p. 42): "For the wetland's dataset, the areas of the Fresno Slough that were continually saturated based on historic imagery were designated as GDEs. The Fresno Slough runs through the entire FCMA. The banks of the Fresno Slough were classified as GDEi in the wetlands data set. Based on historic imagery these areas are only saturated during wet years such as 2011 and 2017. These areas were removed as GDEs." SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface". GDEs can rely on multiple water sources simultaneously and at different temporal/spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow). **Hence, we recommend that depth to groundwater (and not the level of inundation on aerial photography) be used to identify if a connection to groundwater exists. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network.**
- *[Figure 3-37 was updated with separate colors for Vegetation and Wetland GDEs that were kept/removed/added. Thank you for acknowledging the difference between Wetland and Vegetative GDEs, mapping them separately, and providing reasons for each category. We appreciate the County of Fresno's thorough characterization of GDEs. Reasons for those removed/added were provided in the text, however, acreages were not provided. The GSA's response stated that "Acreages of GDEs maintained and removed are not required by regulations." While this is true, the GSP would benefit from providing the acreages kept/removed/added and the reasons for each, which would serve to protect GDEs. The GSA did not submit a GDE shapefile via the SGMA Portal.]* **On Figure 3-37, please provide separate colors for Vegetation and Wetland GDEs removed, as was presented on Figure 2-9, and provide the removal reason. In the text or on the Figure, please cite the acreage of GDEs retained and removed. The basin's GDE shapefile, which is submitted via the SGMA Portal, should include two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).**

- *[The text was updated to refer to Table 3-2. The reference to seepage from the* *Mendota Pool* *was not changed to* *Fresno Slough*.*]* The GSP states (p. 43): "There is also significant seepage from the Mendota Pool to the Shallow Zone of the Upper Aquifer which helps maintain GDEs (Table 3-3)." **Please correct the text to refer to *Table 3-2* and seepage from the *Fresno Slough*.**

Checklist Items 16 to 20, Describing GDEs (23 CCR §354.16)

[Section 3.2.7 Identification of Groundwater Dependent Ecosystems (p. 41-43)]

- *[The GSA's response states that GSP regulations do not require the identification of individual species. No changes to GSP text made.]* In Section 3.2.7.2, the GSP discusses mapped critical habitat of the endangered Fresno Kangaroo Rat as shown in Figure 3-38. However, this is only a very limited evaluation of ecological conditions and assessment of conservation value of GDEs. **Please provide an ecological inventory (see Appendix III, Worksheet 2 of the GDE Guidance) for all potential GDEs that includes the vegetation types or habitat types and rank the GDEs as having a high, moderate or low value; and what characterizes the rank.**
- **Please refer to GDE Pulse (https://gde.codefornature.org; See Attachment E of this letter for more details) or any other locally available data to describe depth to groundwater trends in and around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI).** Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in FCMA:



[Section 3.2.7.3 Impacts to GDEs (p. 37)]

- *[The GSA's response was "Comment noted." No changes to GSP text made.]* The evaluation of impacts to GDEs is to be performed when defining undesirable results in the SMC section of GSP, not the Basin Setting section. **Please consider moving this discussion and consolidating it with Section 4.4 Undesirable Results**.

Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)

[Section 3.3.6 Quantification of Current, Historic, and Projected Water Budget (p. 44-53)]

- *[The GSA's response addresses the comment, but no change to GSP text made.]* The water budget was calculated with the USGS MODFLOW-NWT model (Niswonger et al., 2011) for an area larger than the boundaries of FCMA, as shown on Figure 3-39. **Please explain how the extended area affects the accuracy of the model projections for the FCMA.**
- *[The GSA's response states that natural vegetation includes riparian vegetation, but no changes to GSP text made.]* Appendix I (p. 19-20) states: "Crop coefficients for different land surface characteristics, including non-irrigated lands such as bare ground, barren/fallow lands and natural vegetation, were calculated based on the UC Davis Basic Irrigation Scheduling (BIS) application developed by Snyder et al. (2000, 2008) at monthly frequency." **Please clarify whether the term "natural vegetation" includes riparian vegetation for evapotranspiration for the historical, current, and future water budgets.**
- *[Table 3-5 (p. 47) has been updated and identifies recharge ponds and canals as other direct recharge. Thank you for providing clarification regarding recharge ponds and canals in the water budget.]* The term "Other Direct Recharge" is not defined, and although it is shown in Current and Historic Groundwater Budget (Table 3-8), it is not included in the Projected Budget (Table 3-9). **Please explain how this term is derived and what it represents.**

Checklist Items 23 to 25 – Sustainability Goal (23 CCR §354.24)

[Section 4.1 Sustainability Goal (p. 57)]

- *[The GSA's response was "Comment noted." No change to GSP text made.]* The GSP states the Sustainability Goal as (p. 57): "FCMA will manage groundwater resources in a manner that results in the absence of undesirable results for the Upper Aquifer by the year 2040." The sustainability goal does not specifically mention beneficial uses or users of groundwater, including environmental users. **Please rephrase the Sustainability Goal to specifically call out beneficial uses and users of groundwater, including environmental users. Please state how the sustainability of environmental uses will be protected. In addition, a statement about any intention to address pre-SGMA impacts should be included.**

Checklist Item 26 – Measurable Objectives (23 CCR §354.30)

[Section 4.2.1 Measurable Objectives for Chronic Lowering of Water Levels (p. 58)]

- *[The GSA's response addresses the comment, but no changes to GSP text made.]* The description of Measurable Objectives does not explain how GDEs were considered. **Please include GDEs in this section and explain how the Measurable Objectives and Interim Milestones will help achieve the Sustainability Goal as it pertains to the environment.**

[Section 4.2.4 Measurable Objectives for Degraded Water Quality (p. 61)]

- *[The GSA's response does not address the comment, and no changes to GSP text made.]* The description of Measurable Objectives does not consider how water quality needs of GDEs were considered. **Please include a discussion about GDEs and water quality and whether the Measurable Objectives and Interim Milestones will help achieve the Sustainability Goal as it pertains to the environment.**
- *[The GSA's response does not address the comment, and no changes to GSP text made.]* This section describes how for this sustainability indicator, Management Area A and B are designated as separate management areas, based on existing groundwater quality studies and regulatory guidelines. **Please incorporate discussion of the management areas into the explanation of how GDEs will be protected by the SMC for this sustainability indicator.**

[Section 4.2.5 Measurable Objectives for Interconnected Surface Waters (p. 63)]

- *[The GSA's response was "Comment noted." No changes to GSP text made.]* The GSP states (p. 57): "This area has been designated as a management area because it has no control over water levels in the Fresno Slough. FCMA will prevent undesirable results to surrounding areas by managing groundwater elevations to sustainable levels." **Please describe the regulatory requirements that affect surface water deliveries to the Fresno Slough and describe the conditions under which Undesirable Results *could* occur, even if outside of the control of FCMA.**

Checklist Item 27-29 – Minimum Thresholds (23 CCR §354.28)

[Section 4.3.1 Minimum Thresholds for Chronic Lowering of Groundwater Levels (p. 65)]

- *[The GSA's response does not address the comment. No changes to GSP text made.]* The discussion of Minimum Thresholds does not consider GDEs. **Please include a discussion of GDEs and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**
- *[The GSA's response does not address the comment because the data gaps section cited does not specifically describe the data gap in shallow groundwater levels in the MWA. No changes to GSP text made.]* The GSP states (p. 66): "For most of the FCMA, there was either no groundwater elevation data present where GDEs are present, primarily the MWA, or groundwater elevations were at a depth that exceeded the 30 ft threshold which was used to identify GDEs," and goes on to state (p. 67): "If water levels are ever to drop to MT levels, which is not projected to occur, further analysis of the vertical gradient in the Shallow Zone of the Upper Aquifer will be necessary to better understand the potential impacts to GDEs."

Please specifically cite the data gap in shallow groundwater levels across FCMA in this section, and state how the data gap will be reconciled or refer to a subsequent section of the document.

[Section 4.3.4 Minimum Thresholds for Groundwater Quality (p. 69)]

- *[The GSA's response does not address the comment. No changes to GSP text made.]* The GSP states (p. 71): "The impact high salinity in groundwater could have on freshwater aquatic plants and animals is not well understood in the San Joaquin Valley (USBR, 2018)." **Please further discuss the possible impacts to environmental users from the Minimum Thresholds for TDS proposed in Table 4-10, in the context of information provided in USBR, 2018 and other sources.**

Checklist Item 30-46 – Undesirable Results (23 CCR §354.26)

[Section 4.4.1.1 Description of Undesirable Results for Groundwater Elevation (p. 75)]

- *[The GSA's response was "Comment noted." No GSP text changes made.]* The GSP states (p. 75): "Undesirable results occur when more than 25% of wells in the Upper Aquifer exceed the established MT value for two consecutive years." The use of 25 percent to define an undesirable result does not allow for the occurrence of low water levels in one area, such as near a GDE, to be an Undesirable Result. Damage to GDEs can occur within a relatively short period of time and can be irreversible, leading to a permanent loss. A percentage violation trigger is therefore an insufficient method to prevent undesirable results to environmental users of groundwater. **Please consider the use of separate management areas for the GDE Units, so that Sustainable Management Criteria protective of GDEs can be established for the GDE Units. Please elaborate on how the exceedance criteria would be applied in a way that is protective of significant and unreasonable harm to GDEs.** A procedure could be included for violation of minimum thresholds that includes early identification of potential GDE impacts and appropriate response actions. This could be accomplished efficiently and cost-effectively using remote sensing tools, such as GDE Pulse.
- *[The GSA's response was "Comment noted." No GSP text changes made.]* **Please provide more specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs.** The definition of 'significant and unreasonable' is a qualitative statement that is used to describe when undesirable results would occur in the basin, such that a minimum threshold can be quantified. Potential effects on all beneficial users of groundwater in the basin need to be taken into consideration. According to the California Constitution Article X, §2, water resources in California must be "put to beneficial use to the fullest extent of which they are capable". **Please identify appropriate biological indicators that can be used to monitor potential impacts to environmental beneficial users due to groundwater conditions. Refer to Appendix E of this letter for an overview of a free, new online tool for monitoring the health of GDEs over time.**

[Section 4.4.1.4 Description of Undesirable Results for Groundwater Quality (p. 75)]

- *[The GSA's response was "Comment noted." No GSP text changes made.]* The GSP states (p. 75): "Undesirable Results occur when more than 25% of wells in MAA or MAB exceed the established MT for two consecutive years." As stated above, the use of 25 percent to define an undesirable result does not allow for the occurrence of low water levels in one area, such as near a GDE, to be an Undesirable Result. Damage to GDEs can occur within a relatively short period of time and can be irreversible, leading to a permanent loss. A percentage violation trigger is therefore an insufficient method to prevent undesirable results to environmental users of groundwater. **Please consider the use of separate management areas for the GDE Units, so that Sustainable Management Criteria protective of GDEs can be established for the GDE Units. Please elaborate on how the exceedance criteria would be applied in a way that is protective of significant and unreasonable harm to GDEs.** A procedure could be included for violation of minimum thresholds that includes early identification of potential GDE impacts and appropriate response actions. This could be accomplished efficiently and cost-effectively using remote sensing tools, such as GDE Pulse.

[Section 4.4.1.5 Description of Undesirable Results for Interconnected Surface Water (p. 76)]

- *[Section 4.4.1.5 was updated and states that the impacts to GDEs due to potential undesirable results will be further evaluated as more data is collected and data gaps are filled. TNC appreciates your willingness to further refine potential undesirable results that may impact GDEs.]* The GSP states (p. 76): "Undesirable results occur when stage values drop below the MT for two consecutive years. Undesirable results for interconnected surface waters will not trigger any management action as FCMA has no control over water levels in the Fresno Slough." The cause-effect relationship between surface water levels and the biological responses that could result in significant and unreasonable impacts to ISWs and GDEs depends on a number of factors, and this relationship is not characterized or discussed. **Please describe what Undesirable Results could be expected when stage values drop below the MT for two consecutive years.**

<u>Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)</u>

[Section 4.5.2 Groundwater Elevation Monitoring Network (p. 79)]

- *[The GSA's response restates a previous sentence from Section 4.5.2 and does not address our comment. The text in Section 4.5.6 (p.80) was revised to state that "the FCMA will work to improve the Interconnected Surface Water Monitoring Network by installing shallow groundwater monitoring wells in the Mendota Wetland Area to be able to better characterize the relationship between GDEs and ISWs in this area."]* **Please incorporate the discussion of data gaps presented in Section 3.1.8 (p. 33) into the Monitoring Network section.** As discussed on page 33, there are no wells in the MWA and the GSA has been unsuccessful in working with CDFW to obtain well construction information on existing wells or to obtain access to construct a new well. This is a data gap for which the GSA states that they will continue to work with DWR, CDFW and private duck clubs to obtain access to construct a new well.

- *[The GSA's response addresses the comment, but no GSP text changes made.]* The five wells that are proposed for monitoring groundwater levels are shown in Figure 4-1. The single well for the Lower Aquifer, USGS 31J6, is located outside of the FCMA. The GSP states that there is no known pumping in the FCMA from the Lower Aquifer, and that the FCMA is not expected to extract groundwater from the Lower Aquifer. Lower Aquifer conditions will be monitored and managed in coordination with other entities that utilize the Lower Aquifer as a source of groundwater. **Please consider the installation of a nested well to study the impact of pumping from the Lower Aquifer in areas adjacent to FCMA to shallow groundwater levels in FCMA. Despite no current pumping from the Lower Aquifer in FCMA, pumping from this aquifer could occur in the future.**
- *[The GSA's response addresses the comment, but no GSP text changes were made. The GSP would benefit from the inclusion of information about installing additional shallow wells and/or staff gauges at related surface water monitoring locations to fill data gaps in the monitoring network, which would serve to protect ISWs and GDEs.]* Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater *and related surface conditions* (emphasis added). Groundwater level monitoring alone may be insufficient to establish a linkage between groundwater extraction and potentially resulting impacts to environmental resources associated with GDEs and ISWs. The Mendota Pool staff gage will continue to be measured; it is the only monitoring that is planned for the ISWs. The cause-effect relationship between groundwater levels and the biological responses that could result in significant and unreasonable impacts to ISWs and GDEs depends on a number of factors, and this relationship is not characterized or discussed. **As such, it is not possible to determine whether the proposed monitoring is sufficiently protective to ensure significant and unreasonable impacts to GDEs and ISWs will be prevented. Please expand the discussion of the monitoring program to discuss how ISWs and GDEs will be protected.**

Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)

[Section 5 Projects and Management Actions to Achieve Sustainability Goal (p. 86)]

- *[The GSA's response was "Comment noted". No GSP text changes made.]* The GSP states that no PMAs (Projects and Management Actions) have been formally developed for FCMA. **If and when future projects are planned, please include environmental benefits and multiple benefits as criteria for assessing project priorities.** Environmental users and uses should be considered in establishing new projects. In addition, consistent with existing grant and funding guidelines for SGMA-related work, consideration may be given to multi-benefit projects that can address water quantity as well as providing environmental benefits or benefits to disadvantaged communities.
- **Please consider adding Management Actions which include education and outreach for protection of GDEs and ISWs.**

Attachment C

Freshwater Species Located in the Delta-Mendota Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Delta-Mendota Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[3]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[4] as well as on TNC's science website[5].

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
BIRD				
Agelaius tricolor	Tricolored Blackbird	BCC	SSC	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		SSC	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		SSC	

[3] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[4] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[5] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		SSC	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	BCC	SSC	BSSC - Third priority
Dendrocygna bicolor	Fulvous Whistling-Duck		SSC	BSSC - First priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	BCC	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	BCC	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		SSC	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		SSC	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		SSC	BSSC - Third priority
CRUSTACEAN				
Branchinecta conservatio	Conservancy Fairy Shrimp	Endangered	SSC	IUCN - Endangered
Branchinecta longiantenna	Longhorn Fairy Shrimp	Endangered	SSC	IUCN - Endangered
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	SSC	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	SSC	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		SSC	IUCN - Near Threatened
Artemia franciscana	San Francisco Brine Shrimp			
Branchinecta lindahli	Versatile Fairy Shrimp			
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Pogonichthys macrolepidotus	Sacramento splittail		SSC	Vulnerable - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	SSC	Vulnerable - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	SSC	Endangered - Moyle 2013
Acipenser transmontanus	White sturgeon		SSC	Vulnerable - Moyle 2013
Archoplites interruptus	Sacramento perch		SSC	Endangered - Moyle 2013

Scientific Name	Common Name	Legally Protected Status		
		Federal	**State**	**Other**
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Cottus asper ssp. 1	Prickly sculpin			Least Concern - Moyle 2013
Entosphenus tridentata ssp. 1	Pacific lamprey		SSC	Near-Threatened - Moyle 2013
Gasterosteus aculeatus microcephalus	Inland threespine stickleback		SSC	Least Concern - Moyle 2013
Hysterocarpus traskii traskii	Sacramento tule perch		SSC	Near-Threatened - Moyle 2013
Lampetra ayersi	River lamprey		SSC	Near-Threatened - Moyle 2013
Lampetra hubbsi	Kern brook lamprey		SSC	Vulnerable - Moyle 2013
Lampetra richardsoni	Western brook lamprey			Near-Threatened - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		SSC l	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		SSC	Near-Threatened - Moyle 2013
Mylopharodon conocephalus	Hardhead		SSC	Near-Threatened - Moyle 2013
Oncorhynchus tshawytscha - CV fall	Central Valley fall Chinook salmon	SSC	SSC	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV late fall	Central Valley late fall Chinook salmon	SSC		Endangered - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
HERP				
Actinemys marmorata marmorata	Western Pond Turtle		SSC	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	SSC	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	SSC	ARSSC

Scientific Name	Common Name	Legally Protected Status		
		Federal	**State**	**Other**
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	SSC	ARSSC
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
Pseudacris regilla	Northern Pacific Chorus Frog			
Thamnophis atratus atratus	Santa Cruz Gartersnake			Not on any status lists
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis hammondii hammondii	Two-striped Gartersnake		SSC	ARSSC
INSECT & OTHER INVERTEBRATES				
Aeshnidae fam.	Aeshnidae fam.			
Anax junius	Common Green Darner			
Brillia spp.	Brillia spp.			
Callicorixa spp.	Callicorixa spp.			
Chironomus spp.	Chironomus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corisella spp.	Corisella spp.			
Cricotopus spp.	Cricotopus spp.			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Paraleptophlebia associata	A Mayfly			
Paratanytarsus spp.	Paratanytarsus spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Procladius spp.	Procladius spp.			
Psectrocladius spp.	Psectrocladius spp.			
Tanypus spp.	Tanypus spp.			
Tipulidae fam.	Tipulidae fam.			
Trichocorixa spp.	Trichocorixa spp.			
Capnia hitchcocki	Arroyo Snowfly			
Mesocapnia bulbosa	Bulbous Snowfly			
MAMMAL				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Anodonta californiensis	California Floater		SSC	
Margaritifera falcata	Western Pearlshell		SSC	
Pyrgulopsis diablensis	Diablo Range Pyrg		SSC	E
PLANT				
Chloropyron molle hispidum			SSC	CRPR - 1B.1
Chloropyron palmatum	NA	Endangered	SSC	CRPR - 1B.1
Eryngium racemosum	Delta Coyote-thistle		Endangered	CRPR - 1B.1
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle		SSC	CRPR - 1B.2
Navarretia prostrata	Prostrate Navarretia		SSC	CRPR - 1B.1
Puccinellia simplex	Little Alkali Grass			
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla filiculoides	NA			
Azolla microphylla	Mexican mosquito fern		SSC	CRPR - 4.3
Baccharis salicina				Not on any status lists
Bacopa eisenii	Gila River Water-hyssop			
Bidens laevis	Smooth Bur-marigold			
Bolboschoenus glaucus	NA			Not on any status lists
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Callitriche marginata	Winged Water-starwort			
Ceratophyllum demersum	Common Hornwort			
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Crypsis vaginiflora	NA			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus squarrosus	Awned Cyperus			
Downingia bella	Hoover's Downingia			
Downingia pulchella	Flat-face Downingia			
Echinodorus berteroi	Upright Burhead			
Elatine brachysperma	Shortseed Waterwort			
Elatine californica	California Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis atropurpurea	Purple Spikerush			
Eleocharis coloradoensis				Not on any status lists
Eleocharis macrostachya	Creeping Spikerush			

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Eleocharis montevidensis	Sand Spikerush			
Eleocharis quadrangulata	NA			
Elodea canadensis	Broad Waterweed			
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eragrostis hypnoides	Teal Lovegrass			
Eryngium castrense	Great Valley Eryngo			
Eryngium vaseyi vallicola				Not on any status lists
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Juncus acuminatus	Sharp-fruit Rush			
Juncus xiphioides	Iris-leaf Rush			
Lasthenia ferrisiae	Ferris' Goldfields		SSC	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Lemna aequinoctialis	Lesser Duckweed			
Lemna gibba	Inflated Duckweed			
Lemna minor	Lesser Duckweed			
Lepidium jaredii jaredii	Jared's Pepper-grass		SSC	CRPR - 1B.2
Lepidium oxycarpum	Sharp-pod Pepper-grass			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limosella acaulis	Southern Mudwort			
Lipocarpha micrantha	Dwarf Bulrush			
Ludwigia peploides peploides	NA			Not on any status lists
Ludwigia repens	Creeping Seedbox			
Lythrum californicum	California Loosestrife			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus guttatus	Common Large Monkeyflower			
Montia fontana fontana	Fountain Miner's-lettuce			
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Myriophyllum aquaticum	NA			
Najas guadalupensis guadalupensis	Southern Naiad			
Navarretia heterandra	Tehama Navarretia			

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Navarretia leucocephala leucocephala	White-flower Navarretia			
Neostapfia colusana	Colusa Grass	Threatened	Endangered	CRPR - 1B.1
Panicum dichotomiflorum	NA			
Paspalum distichum	Joint Paspalum			
Persicaria hydropiperoides				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria pensylvanica	NA			Not on any status lists
Phacelia distans	NA			
Phyla lanceolata	Fog-fruit			
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Pluchea odorata odorata	Scented Conyza			
Pogogyne douglasii	NA			
Pogogyne zizyphoroides				Not on any status lists
Potamogeton diversifolius	Water-thread Pondweed			
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton nodosus	Longleaf Pondweed			
Potamogeton pusillus pusillus	Slender Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Psilocarphus tenellus	NA			
Ranunculus sceleratus	NA			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rorippa palustris palustris	Bog Yellowcress			
Rotala ramosior	Toothcup			
Ruppia cirrhosa	Widgeon-grass			

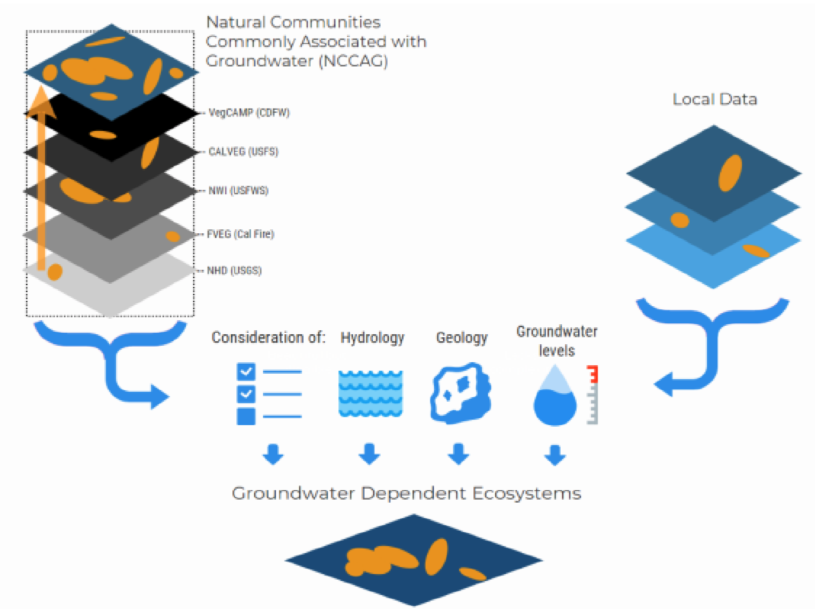
Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Ruppia maritima	Ditch-grass			
Sagittaria longiloba	Longbarb Arrowhead			
Sagittaria montevidensis calycina				Not on any status lists
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus americanus	Three-square Bulrush			
Sinapis alba	NA			
Sparganium eurycarpum eurycarpum				
Stuckenia pectinata				Not on any status lists
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica americana	American Speedwell			
Wolffiella lingulata	Tongue Bogmat			
Zannichellia palustris	Horned Pondweed			
Notes: ARSSC = At-Risk Species of Special Concern BCC = Bird of Conservation Concern BSSC = Bird Species of Special Concern CRPR = California Rare Plant Rank IUCN = International Union for Conservation of Nature SSC = Species of Special Concern				

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[6] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[7]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[6] *NC Dataset Online Viewer:* *https://gis.water.ca.gov/app/NCDatasetViewer/*
[7] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[8]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[9] on the Groundwater Resource Hub[10], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[8] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[9] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[10] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

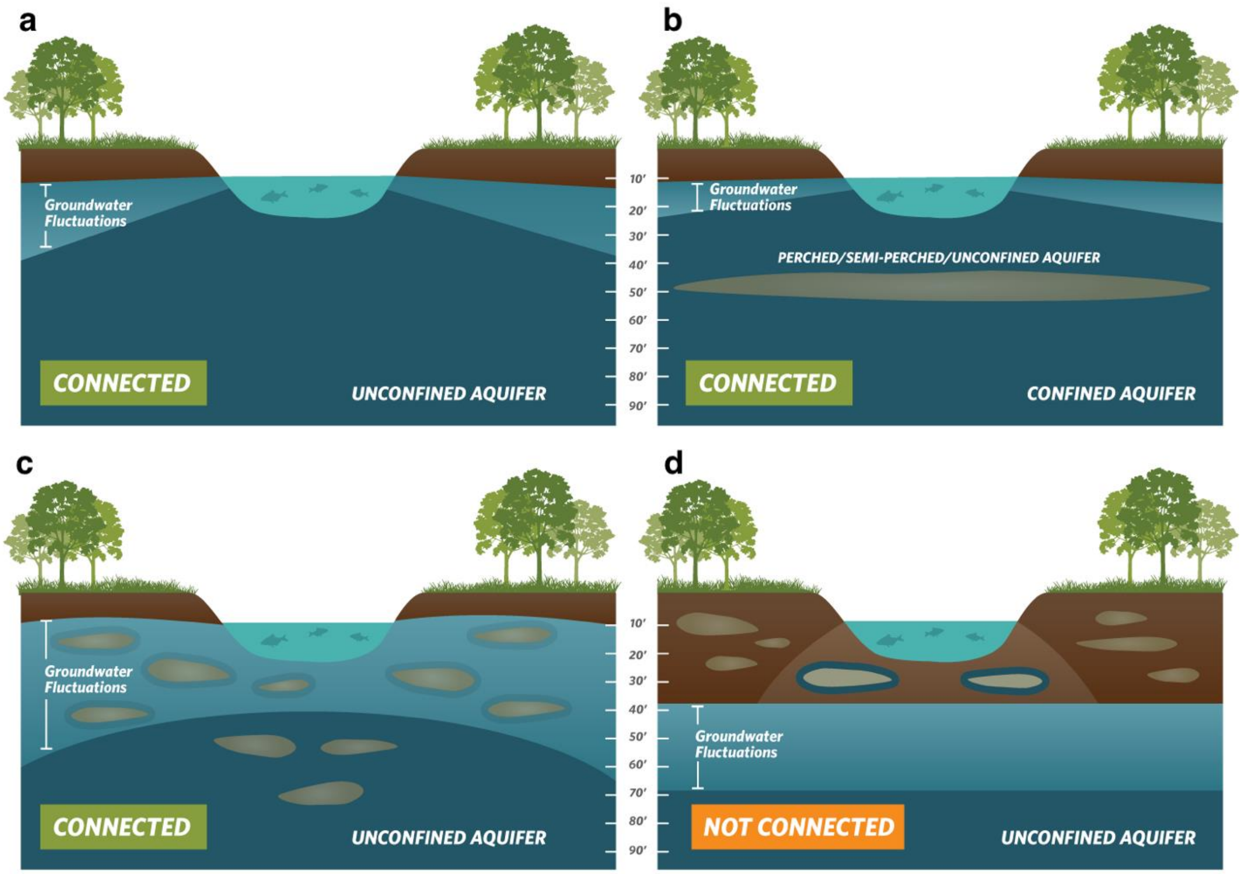

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[11] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[12] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[13] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[14]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network (see Best Practice #6).

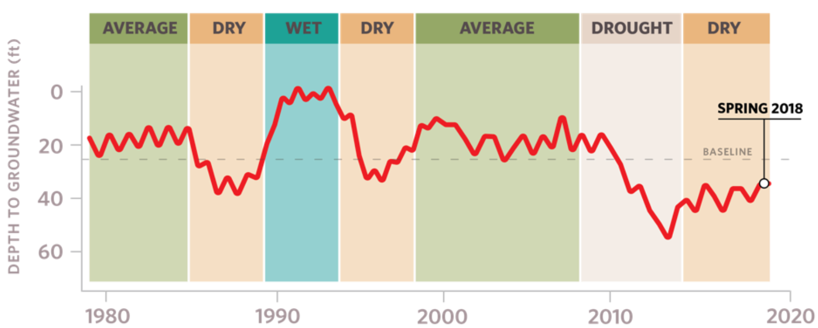

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[11] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[12] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[13] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[14] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[15], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

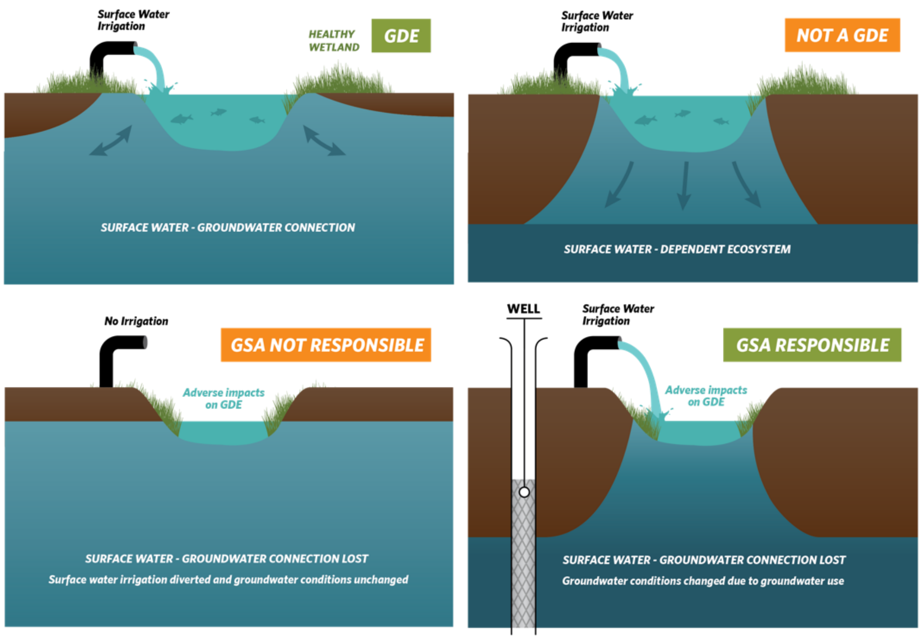


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[15] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

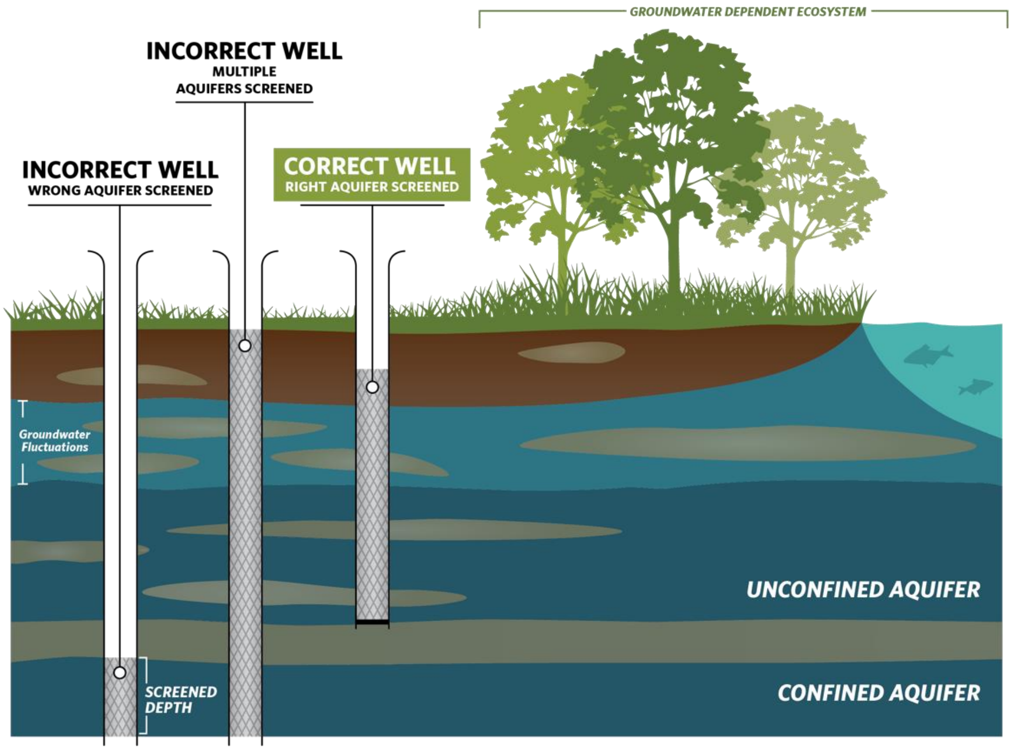


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[16] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

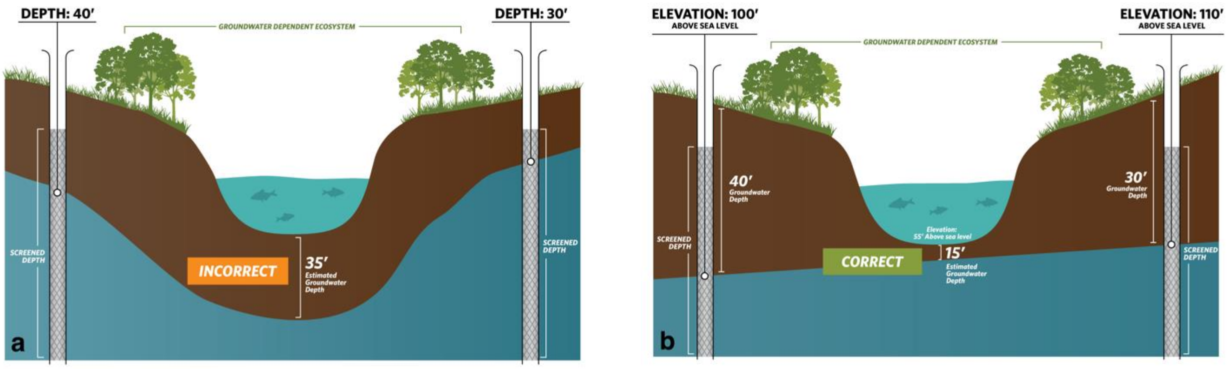


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

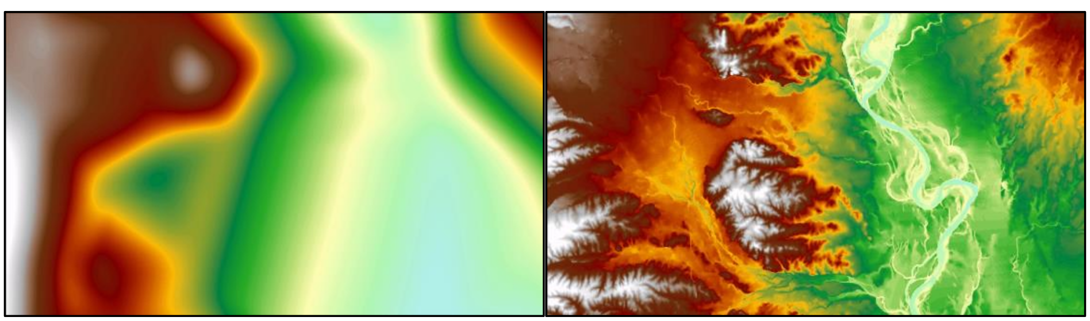


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[16] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

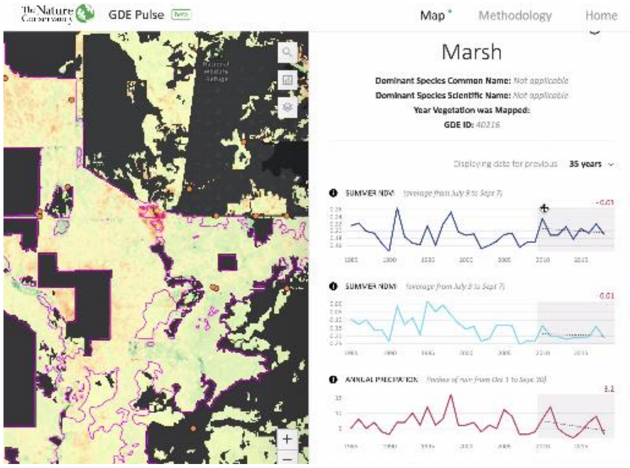
The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

Visit
https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[17]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[18]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[17] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[18] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F

The GSA Response to TNC Comments on the Draft GSP is submitted to DWR as attachment 2 of 2 on the SGMA portal.

Attachment F

Mapping Likely Interconnected Surface Water
The Nature Conservancy, California, May 2020

Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, ISW is defined as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:
The groundwater elevation data, available for Spring 2011-2012, and Spring and Fall 2013-2018, comes from the California Department of Water Resources (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). These data are represented as continuous raster layers that approximates "feet above or below mean sea level" based on groundwater well measurements. According to the documentation online, groundwater level measurements were selected based on measurement date and well construction information (where available) and are intended to approximate the groundwater levels in the unconfined to uppermost semi-confined aquifers. Each of the raster layer has a different extent, but all of them are limited to the Central Valley. To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

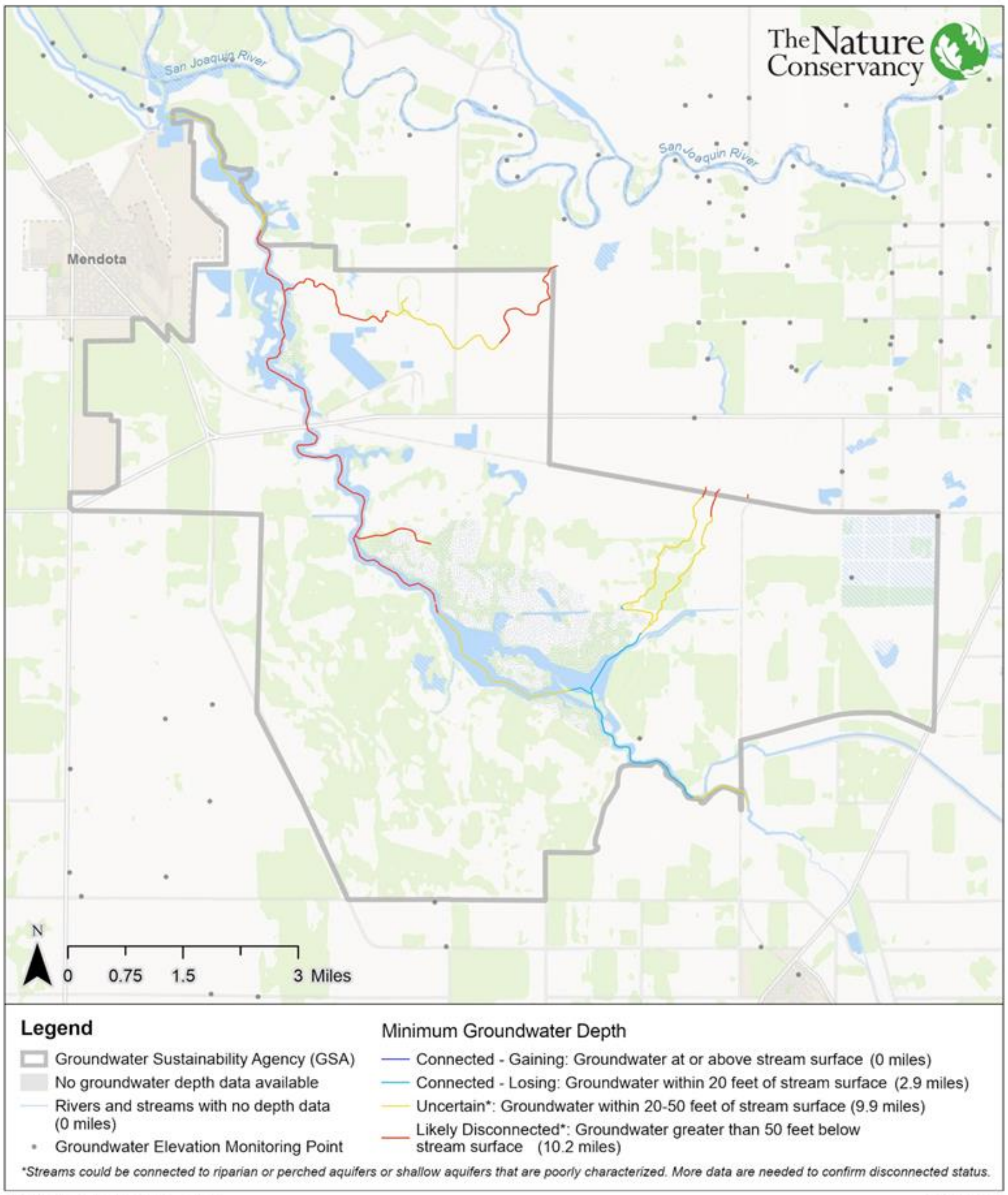
The map splits groundwater depth into four categories:

- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.
- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.

Interconnected Surface Water: Minimum Groundwater Depth (2011-2018)

County of Fresno GSA Management Area A & Management Area B GSP



5-022.07_DeltaMendota_FresnoCounty

Data Sources:
CA Dept. of Water Resources Groundwater Elevation Data, gis.water.ca.gov/app/gicima/
NHD Plus V2 Streams, nhdplus.com/NHDPlus/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[19]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[20]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[21] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[19] https://www.ncbi.nlm.nih.gov/pubmed/12753220
[20] Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009
[21] Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015

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The Nature Conservancy
Protecting nature. Preserving life.

CALIFORNIA WATER | **GROUNDWATER**

June 3, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Greater Kaweah Groundwater Sustainability Plan (GSP), Kaweah Subbasin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Greater Kaweah Groundwater Sustainability Agency's (GSA's) Greater Kaweah Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing sustainable groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be insufficient in addressing environmental beneficial uses and users.

The identification of environmental beneficial users, as well as their consideration when establishing the sustainability goal, undesirable results, minimum thresholds and measurable objectives were unreasonable (23 CCR §355.4(b)(4)) and lacked best available science (23 CCR §355.4(b)(1)). In the face of existing, severe overdraft, the GSP would allow groundwater management to largely ignore potential impacts to environmental beneficial users. This could result in irreparable harm to these beneficial users, undermining the intent of SGMA to achieve sustainability.

Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address gaps within 180 days. In these cases, we strongly recommend that the Department, at a minimum, set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update. Should the treatment of environmental beneficial users be indicative of the quality of the overall plan, then we recommend the Department deem the plan inadequate.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides the GSA's response to TNC's comments on the Draft GSP. Attachment G provides a map and method summary of potential ISW.

<u>Our Key Considerations</u>

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We are disappointed to see the feedback that we provided on the draft GSP has been ignored in the final plan, as only 1 out of 38 of our comments were adequately addressed in the Final GSP. This indicates poor engagement of environmental beneficial users, which undermines the intent of SGMA to ensure that sustainability be defined locally with the participation of all users. Based on our experience the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan" (23 CCR §355.4(b)(10)).

<u>TNC recommendation</u>: We strongly recommend that DWR require the GSA to prioritize stakeholder engagement through improvements to their stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters (ISWs) – The GSP incorrectly excluded potential and/or actual ISWs because the plan did not employ the best available science. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). ISWs were not consistently or adequately analyzed in the GSP. The GSP provides a narrative description of surface water reaches in the Kaweah subbasin, but does not attempt to specify interconnected reaches or estimate the quantity and timing of streamflow depletions. Therefore, potential ISWs may not be managed in the GSP.

Map and Assessment of potential ISWs:
By combining multiple years and seasons of groundwater depth data, The Nature Conservancy's assessment has found that within the Greater Kaweah GSP, 0.7 river miles are likely to be gaining, 14.9 are likely to be losing, and the rest are uncertain or likely disconnected (based on streams with available groundwater depth data). Attachment G contains a one-page method summary and a GSP-specific map of ISWs. The interconnected surface water displayed on the map is based on the minimum groundwater depth estimated by the California Department of Water Resources between 2011 and 2018.

Note: In most cases, the groundwater depth data used to generate the ISW map does not include perched aquifers. As such, some streams marked as disconnected could in actuality, be connected.

TNC recommendation: Until a disconnection can be proven, TNC recommends that the GSP include all potential and confirmed ISWs. We recommend that the GSA conduct a thorough analysis of existing data on surface water-groundwater interconnectivity and estimate the quantity and timing of streamflow depletions in the subbasin. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 2,784 acres of potential GDEs occur in the GSA boundary. TNC developed the *Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs*[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

The plan does not adequately identify, map and consider GDEs. We believe that this does not meet plan evaluation criteria (1), (4) and (10), as defined in the 23 CCR §355.4(b). In addition, the Plan does not satisfy the requirement to identify GDEs (23 CCR §Section 354.16(g)) and consider beneficial users throughout the plan. Our review found that NC Dataset polygons were improperly removed from the GDE map based on groundwater levels that were greater than 50 feet at a single point in time. While we appreciate the use of a more conservative groundwater depth threshold, this is a technically problematic approach since groundwater levels fluctuate over seasonal and interannual time scales due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Justifying the removal of NC dataset polygons solely based on this criterion does not acknowledge that groundwater levels temporally vary and the fact that many plant species within GDEs have adapted water stress strategies to deal with intermittent periods of deep groundwater levels. Using this methodology disregards groundwater fluctuations and can leave many GDEs unidentified and unprotected in the GSP.

TNC recommendation: TNC recommends that the GSA utilize groundwater levels that represent interannual and inter-seasonal variability along with additional information provided in Attachment D on best practices for utilizing the NC dataset to identify and consider GDEs throughout the GSP. Specifically, the GSA should use a Digital Elevation Model (DEM) when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment D.

Water Budget – We would like to commend the GSP for including the groundwater demands of phreatophytes in the historical, current and projected water budgets. As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget. Please clarify if other categories of native vegetation and managed wetlands were included in the water budget, and include them if omitted.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid

[1] *Available at:* *https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf*

adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. As a result, the monitoring network does not adequately characterize GDEs and other environmental beneficial users of surface water and groundwater. Potential GDEs are located in areas of the subbasin where no shallow groundwater monitoring currently exists or is proposed, leaving data gaps unfilled. Potential ISWs have been dismissed in the GSP, without proposed recommendations to improve ISW identification, mapping, and estimates of depletions. Therefore, GDEs and ISWs are not being specifically addressed by the monitoring network in the GSP.

TNC recommendation: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but sustainable groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

<table>
<tr><td rowspan="11"></td><td rowspan="9"></td><td rowspan="3">If NC Dataset was used:</td><td>Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).</td><td>12</td></tr>
<tr><td>The basin’s GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).</td><td>13</td></tr>
<tr><td>GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.</td><td>14</td></tr>
<tr><td>If NC Dataset was not used:</td><td>Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.</td><td>15</td></tr>
<tr><td colspan="2">Description of GDEs included:</td><td>16</td></tr>
<tr><td colspan="2">Historical and current groundwater conditions and variability are described in each GDE unit.</td><td>17</td></tr>
<tr><td colspan="2">Historical and current ecological conditions and variability are described in each GDE unit.</td><td>18</td></tr>
<tr><td colspan="2">Each GDE unit has been characterized as having high, moderate, or low ecological value.</td><td>19</td></tr>
<tr><td colspan="2">Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).</td><td>20</td></tr>
<tr><td rowspan="2">2.2.3
Water Budget
23 CCR §354.18</td><td colspan="2">Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin’s historical and current water budget.</td><td>21</td></tr>
<tr><td colspan="2">Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.</td><td>22</td></tr>
<tr><td rowspan="11">Sustainable Management Criteria</td><td rowspan="3">3.1
Sustainability Goal
23 CCR §354.24</td><td colspan="2">Environmental stakeholders/representatives were consulted.</td><td>23</td></tr>
<tr><td colspan="2">Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.</td><td>24</td></tr>
<tr><td colspan="2">Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.</td><td>25</td></tr>
<tr><td>3.2
Measurable Objectives
23 CCR §354.30</td><td colspan="2">Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.</td><td>26</td></tr>
<tr><td rowspan="3">3.3
Minimum Thresholds
23 CCR §354.28</td><td colspan="2">Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:</td><td>27</td></tr>
<tr><td colspan="2">Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?</td><td>28</td></tr>
<tr><td colspan="2">Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?</td><td>29</td></tr>
<tr><td rowspan="3">3.4
Undesirable Results
23 CCR §354.26</td><td colspan="2">For GDEs, hydrological data are compiled and synthesized for each GDE unit:</td><td>30</td></tr>
<tr><td rowspan="2">If hydrological data are available within/nearby the GDE</td><td>Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).</td><td>31</td></tr>
<tr><td>Baseline period in the hydrologic data is defined.</td><td>32</td></tr>
</table>

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Greater Kaweah Groundwater Sustainability Plan

A complete draft of the Greater Kaweah Groundwater Sustainability Plan (GSP) was provided for public review on September 16, 2019; TNC submitted comments on the Draft GSP on December 13, 2019. Public draft GSP comments and responses, provided as Attachment E of the GSP, were reviewed and are referred to below. The GSP comments and responses are also provided in Attachment F of this letter. We reviewed the responses to comments and the text of the Final GSP (dated January 22, 2020) to determine if changes were made to the Final GSP that addressed TNC's previously submitted comments. This attachment lists our original comments on the complete Public Draft GSP, and states whether or not they were addressed in the Final GSP *[as green text within brackets]*. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

- *[Our comment was partially addressed. Section 1.4.1.10 was added with some background on the environmental groups that were consulted. The entities consulted were Tulare Basin Wildlife Partners and Sequoia Riverlands Trust. It is noted in Section 1.4.1.10 (p. 1-27) that "GKGSA has not identified environmental users of groundwater within the region."]* [Section 1.4.2 Beneficial Uses and Users (p. 1-20 to 1-23)]
    - Surface water users and the following groups were listed as Beneficial Users: "Environmental and ecosystem interests in GKGSA include the Tulare Basin Wildlife Partners and Sequoia Riverlands Trust" (p. 1-23). **Please identify whether or not the following beneficial uses and users of groundwater in the GSA are present: Protected Lands, including preserves, refuges, conservation areas, recreational areas; and other protected lands; and Public Trust Uses, including wildlife, aquatic habitat, fisheries, and recreation.**
    - The types and locations of environmental uses, species and habitats supported, and the designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the GSA should be specified. **To identify environmental users, please refer to the following:**
        - Natural Communities Commonly Associated with Groundwater dataset (NC Dataset) - https://gis.water.ca.gov/app/NCDatasetViewer/
        - The list of freshwater species located in the Kaweah Subbasin in Attachment C of this letter. Please take particular note of the species with protected status.
        - CDFW's California Natural Diversity Database (CNDDB) - https://www.wildlife.ca.gov/Data/CNDDB
        - USFWS's IPAC report for the GKGSA - https://ecos.fws.gov/ipac/

Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8)

- [Section 1.3.6 Land Use Elements (p. 1-11 to 1-14)]
    - *[No GSP text changes were made in response to our comment.]* This section should include a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals. **Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs.**
    - *[No GSP text changes were made in response to our comment.]* This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the GSA and if they are associated with critical, GDE or ISW habitats. **Please identify all relevant HCPs and NCCPs within the GSA and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.**
    - *[No GSP text changes were made in response to our comment.]* Please refer to the Critical Species Lookbook[2] to review and discuss the potential groundwater reliance of critical species in the GSA. **Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.**
- *[No GSP text changes were made in response to our comment.]* [Appendix 2A Section 2.3.1 Existing Groundwater Level Monitoring (p. 37-38)] The monitoring programs are described, but there is no mention of how GDEs are monitored and protected. **Please describe how existing groundwater monitoring programs are protective of GDEs, or propose additional monitoring that specifically targets GDEs.**
- *[No GSP text changes were made in response to our comment.]* [Appendix 2A Section 2.3.4 Existing Stream Flow Monitoring (p. 50)] This section describes the programs of USACOE, Kaweah and St. Johns Rivers Association (KSJRA) and the ditch companies. Surface water sources are listed along with the group monitoring them. Small surface streams which pass through TID's service area are noted as used, but the names are not listed. There is no mention of ISWs or GDEs and how they are monitored. **Please explain how existing stream flow monitoring is protective of ISWs and GDEs.**
- [Section 1.3.7.7 Well Construction Policies (p. 1-16)]
    - *[No GSP text changes were made in response to our comment.]* The GSP states (p. 1-16): "Tulare and Kings Counties have each adopted an ordinance for the construction of wells, based on California Well Standards as presented in DWR Bulletins 74-81 and 74-90." **Please include a discussion of how future well permitting will be coordinated with the GSP to assure achievement of the Plan's sustainability goals.**

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[2] The Critical Species LookBook is available at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

- *[No GSP text changes were made in response to our comment.]* The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF v. SWRCB and Siskiyou County, No. C083239). **Compliance of well permitting programs with this requirement should be stated in the GSP.**

Checklist Items 5, 6, and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

- *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* [Appendix 2A Section 2.2.4 Bottom of the Subbasin (p. 22)] The base of the Subbasin corresponds with the base of freshwater. "This is generally defined as the elevation below which total dissolved solids are greater than 2,000 milligrams per liter (mg/l) (Bertoldi et al, 1991)" (p. 22 of Appendix 2A). As noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** Properly defining the bottom of the basin will prevent the possibility of extractors with wells deeper than the basin boundary from claiming exemption from SGMA due to their well residing outside the vertical extent of the basin boundary.
- *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* [Appendix 2A Section 2.2.1.3 Kaweah Subbasin Geology (p. 17-21)] Basin-wide cross sections provided in Figures 4 through 13 are regional, and do not include a graphical representation of the manner in which shallow groundwater may interact with ISWs or GDEs that would allow the reader to understand this topic. **Please consider including an example near-surface cross section that depicts the conceptual understanding of shallow groundwater and stream interactions at different locations, including the Upper Aquifer, as well as any potential GDEs**.

Checklist Items 8, 9, and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)

- *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* [Appendix 2A Section 2.9 Interconnected Surface Water (p. 145)] The discussion of interconnected surface waters should first be introduced in Appendix 2A Section 2.4 (Groundwater Elevation and Flow Conditions §354.16), since the identification of interconnected surface water systems is a required element of Current and Historical Groundwater Conditions (23 CCR §354.16). In Appendix 2A Section 2.4 (Groundwater Elevation and Flow Conditions §354.16), please expand this discussion, in particular:
    - The regulations [23 CCR §351(o)] define interconnected surface waters (ISW) as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is

not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. **Please identify interconnected surface waters in the GSA by relying on groundwater elevation and stream gauge data, specifying any data gaps that exist so that they can be resolved in the monitoring network.**

- ISWs are best estimated by first determining which reaches are completely disconnected from groundwater. This approach would involve comparing groundwater elevations with a land surface Digital Elevation Model that could identify which surface waters have groundwater consistently below surface water features, such that an unsaturated zone would separate surface water from groundwater. ISWs can be either gaining or losing. The defining feature of disconnected surface waters is that groundwater is consistently below surface water features such that an unsaturated zone always separates surface water from groundwater, not whether the reach is gaining or losing. **To improve ISW mapping, please reconcile data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.**

Checklist Items 11 to 15, Identifying and Mapping GDEs (23 CCR §354.16)

- *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* [Appendix 2A Section 2.2.7.3 Delineation of recharge areas, potential recharge areas, and discharge areas, including springs, seeps, and wetlands (p. 33)], and [Appendix 2A Section 2.10 Groundwater Dependent Ecosystems (p. 146)] Both of the above referenced sections refer to or include discussion of the identification of groundwater dependent ecosystems (GDEs). **Please consolidate and expand these sections of the document in GSP Appendix 2A Section 2.4 (Groundwater Elevation and Flow Conditions §354.16), since the identification of groundwater dependent ecosystems (GDEs) is a required element of Current and Historical Groundwater Conditions (23 CCR §354.16)**. This is a more appropriate place for the identification of GDEs, since groundwater conditions (e.g., depth to groundwater, interconnected surface water maps, groundwater quality) are necessary local information and data from the GSP in assessing whether polygons in the NC dataset are connected to groundwater in a principal aquifer. For detailed guidance on how to address GDEs, please see our publication, *GDEs under SGMA: Guidance for Preparing GSPs*[3]. In particular, note the following:
  - *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* **Please provide a comprehensive discussion and figure(s) for the identification of GDEs**. Figure 19 of Appendix 2A is titled "Potential Groundwater Dependent Ecosystems", however the figure does not actually present this. The NC

[3]GDEs under SGMA: Guidance for Preparing GSPs is available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

dataset is a starting point for GSAs to identify GDEs in their area. The NC dataset comprises 3,488 acres of potential GDEs for the entire Kaweah Subbasin, representing a significant amount of GDEs to be considered. **Please map the original NC dataset on Figure 19 or another figure, and document which polygons were added (and what local sources were used to identify them), removed (and the removal reason), and kept (from the original NC dataset)**. The Subbasin's GDE shapefile, which is submitted via the SGMA Portal, should also include two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were added or removed).

- *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* **Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network**. Specifically, please note:
  - *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* **Please provide depth to groundwater contour maps. See Attachment D for best practices for completing this step. Specifically, ensure that the first step is contouring groundwater elevations, and the subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth to groundwater contours across the landscape**. This will provide much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make.
  - *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* Figure 19 presents areas marked as 'Spring 2015 Groundwater Surface within 50 feet of Ground Surface'. Spring 2015 is after the SGMA benchmark date of January 1, 2015. **Please rely on groundwater condition data prior to the SGMA benchmark date**.
  - *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* It is highly advised that seasonal and interannual groundwater fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one point in time (e.g., Spring 2015) can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. **We highly recommend using depth to groundwater data from multiple seasons and**

water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer**. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network.**

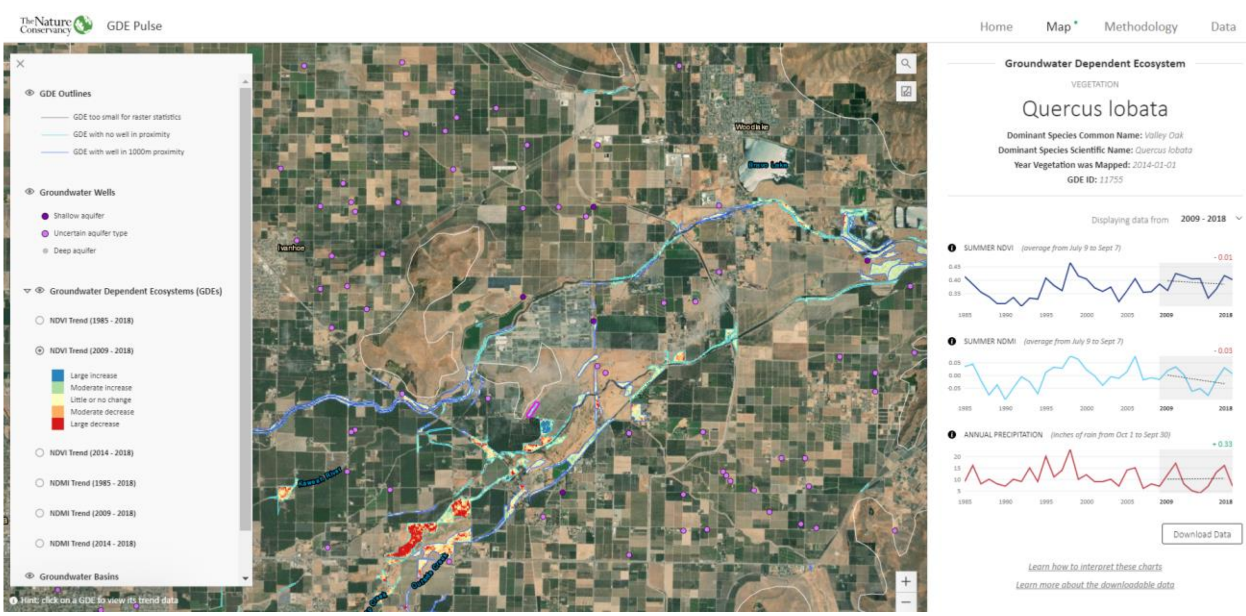
- *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* **Please specify which data were used to determine the elevation of the stream or river bottom and the Valley Oak root zone in the GSA**. Page 5-18 states "The water table lies some 60 to 150 feet below the invert of all three of these channel reaches, which is generally 40 to 130 feet below the root zone of the Valley Oak", however no information is provided on the data used to determine the elevation of the stream or river bottom and these calculations. These depths suggest a root zone of approximately 20 feet, but this is not stated explicitly. Data cited in Lewis and Burgy (1964)[4] indicate root zones deeper than 70 feet for this species in a fractured rock aquifer. Rooting depths for the Valley Oak in this region have not been reported and thus are a data gap. Furthermore, care must be taken when considering rooting depths of vegetation. Rooting depths are likely to spatially vary based on the local hydrologic conditions available to the plant. Maximum rooting depths do not take capillary action into consideration, which will vary with soil type and is an important consideration since woody phreatophytes generally do not prefer to have their roots submerged in groundwater for extended periods of time, and hence can access groundwater at deeper depths. In addition, while it is likely to be true that shallow water availability is necessary to support the recruitment of saplings, hydraulic lift of groundwater to shallow depths has been observed in Quercus spp.
- *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* Page 33 of Appendix 2A states "The locations of these potential GDEs and hydrographs for the Subbasin indicate that the vegetation of these areas are dependent [on] surface water flows, rather than shallow groundwater." We disagree with this statement dismissing all potential GDEs from further consideration. There are 3,488 acres of potential GDEs within the Kaweah Subbasin as per the NC dataset, and the location is, as to be expected, at the interconnection between groundwater and surface water. Adverse impacts can occur to GDEs due to pumping that further separates groundwater from surface

[4] Lewis, D.C. and Burgy, R.H., 1964. The relationship between oak tree roots and groundwater in fractured rock as determined by tritium tracing. Journal of Geophysical Research, 69(12), pp. 2579-2588.

water. **Please provide the rationale for this statement, including the discussion of the type of river reach (i.e., gaining or losing)**. Riparian vegetation may still be accessing groundwater, and hence be identified as a GDE. We highly recommend that depth to groundwater levels under the NC polygons be used as the evaluation criteria, since access to groundwater could be occurring in/near losing reaches. **Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Specifically, it is highly advised that fluctuations in the groundwater regime be characterized in space and time to understand the seasonal and interannual groundwater variability in GDEs.**

<u>Checklist Items 16 to 20, Describing GDEs (23 CCR §354.16)</u>

- [Appendix 2A Section 2.10 Groundwater Dependent Ecosystems (p. 146)]
    - *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* **Once potential GDEs are identified, please provide information on the historical or current groundwater conditions in the GDEs or the ecological conditions present**. Refer to GDE Pulse (https://gde.codefornature.org; See Attachment E of this letter for more details) or any other locally available data to describe depth to groundwater trends in and around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in the Greater Kaweah GSA:



- *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* **Once potential GDEs are identified, provide an inventory of the vegetation types or habitat types and rank the vegetation species as having a high, moderate or low value. Please identify whether any endangered or threatened freshwater species of animals and plants or areas with critical habitat were found in any of the GDEs**. The list of freshwater species located in the Kaweah Subbasin can be found in Attachment C of this letter.

<u>Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)</u>

- *[Our comment was addressed. Phreatophyte extraction is defined in the final GSP. This element was added to the water budget, and it is noted that this is a minor component of the water budget. This is presented in Table 30 (p. 102) of Appendix 2A.]* Please clarify what the term "phreatophyte extraction' means. The text states 'Phreatophyte extraction consists of removing vegetation in riparian areas to prevent consumptive water use." If phreatophytes were indeed removed from within the Subbasin, please provide further details. If phreatophyte extraction refers to the uptake of groundwater by phreatophytes, then correct this text. It should be clearly stated if the phreatophytes referred to are potential GDE vegetation.
- *[No GSP text changes were made in response to our comment.]* **Please clarify what assumptions and data were used to calculate the outflow term from groundwater by phreatophytes.**

<u>Checklist Items 23 to 25 – Sustainability Goal (23 CCR §354.24)</u>

- *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* [Section 3.3 Sustainability Goal (p. 3-2)] "The broadly stated sustainability goal for the Kaweah Subbasin as agreed to by the three GSAs therein is, for each GSA to manage groundwater resources to preserve the quality of life through maintaining the viability of existing enterprises of the region, both agricultural and urban." There is no mention of protection of environmental users including ISWs or GDEs. **Please rephrase the Sustainability Goal to specifically call out all beneficial uses and users of groundwater including environmental users, state how the sustainability of environmental uses will be protected, and expand the goal to include protection of GDEs, ISWs, and critical habitats.**

<u>Checklist Item 26 – Measurable Objectives (23 CCR §354.30)</u>

- *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* [Section 5.2 General Approach (p. 5-1)] Refer to Comments on Checklist Items 8-10 above on the existence of ISWs in the GSA. The GSP seeks to establish non-applicability of the ISW SMC (Table 5-1) and thus the GSP fails to establish Sustainable Management Criteria for this sustainability indicator. However, the existence of potential riparian

GDEs along the streams in the Subbasin has been identified in Appendix 2A, and their connection to groundwater is assumed. Their occurrence in the riparian zone means that these GDEs should be considered a beneficial user of groundwater that could be affected by chronic groundwater level decline as discussed above, as well as beneficial users of surface water that could be depleted by groundwater extraction. **Please include a discussion of Sustainable Management Criteria for ISWs, including Measurable Objectives, in the GSP. A more robust discussion of the known facts regarding these surface-groundwater interactions in the riparian zone should be provided. Please cite data gaps regarding ISWs and make plans to reconcile them in the Monitoring Section of the GSP.**

- *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* [Section 5.3.2 Measurable Objectives for Groundwater Levels (p. 5-10 to 5-11)] The measurable objective was set equal to the water level at 2030 using the 2006-2016 water level trend for each of the wells selected as representative monitoring sites. The specific measurable objectives for all of the selected wells are listed in Table 5-3 (p. 5-6). **Please explain how the Measurable Objectives will help achieve the Sustainability Goal as it pertains to the environment. After GDEs and ISWs are identified, please discuss if any impacts to GDEs or ISWs are expected. Data gaps should be noted and addressed in the Monitoring section.**

<u>Checklist Items 27 to 29 – Minimum Thresholds (23 CCR §354.28)</u>

- *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* [Section 5.2 General Approach (p. 5-1)] **Following the discussion presented above for Checklist Item 26 (Measurable Objectives), please include a discussion of Sustainable Management Criteria for ISWs, including Minimum Thresholds, in the GSP. Please cite data gaps regarding ISWs and make plans to reconcile them in the Monitoring Section of the GSP.**
- *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* [Section 5.3.1 Minimum Threshold for Groundwater Levels (p. 5-2 to 5-10)] The trend of the 2006-2016 water levels over time was used to set the Minimum Threshold at 2040 for each of the wells, used as representative monitoring sites, in each of eight hydrogeologic zones within the Subbasin (shown on Figure 5.1, p. A5-1). The Minimum Thresholds and other Sustainable Management Criteria for each well are listed in Table 5-3 (p. 5-6). **Please explain how the Minimum Thresholds will help achieve the Sustainability Goal as it pertains to the environment. After GDEs and ISWs are identified, please discuss if any impacts to GDEs or ISWs are expected. Data gaps should be noted and addressed in the Monitoring section.**

<u>Checklist Items 30 to 46 – Undesirable Results (23 CCR §354.26)</u>

- [Section 3.4 Groundwater Levels Undesirable Results (p. 3-4)] After the identification and evaluation of potential GDEs is completed, this section should discuss impacts to those GDEs. Specifically,
    - *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* For chronic lowering of water level, the GSP Committee considered that one-third of the representative monitoring sites (wells) exceeding minimum thresholds for water levels would constitute an undesirable result. There appears to be no additional guidance to protect potential GDEs or ISWs. Damage to GDEs can occur within a relatively short period of time and can be irreversible, leading to the permanent loss of a protected resource. A fractional violation trigger is therefore inadequate to assure that the environmental users are protected. **Please elaborate on how the exceedance criteria would be applied in a way that is protective of significant and unreasonable harm to GDEs. Consider the use of separate management areas for the GDE Units, so that Sustainable Management Criteria protective of GDEs can be established for the GDE Units.** A procedure could be included for violation of Minimum Thresholds that includes early identification of potential GDE impacts and appropriate response actions. This could be accomplished efficiently and cost-effectively using remote sensing tools, such as GDE Pulse.
    - *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* **Please provide more specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs.** The definition of 'significant and unreasonable' is a qualitative statement that is used to describe when undesirable results would occur in the GSA, such that a minimum threshold can be quantified. Potential effects on all beneficial users of groundwater in the GSA need to be taken into consideration. According to the California Constitution Article X, §2, water resources in California must be "put to beneficial use to the fullest extent of which they are capable". **Please identify appropriate biological indicators that can be used to monitor potential impacts to environmental beneficial users due to groundwater conditions. Refer to Appendix E of this letter for an overview of GDE Pulse.**
    - *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* The GSP states (p. 3-5): "The potential effects of lowered groundwater levels, when approaching or exceeding minimum thresholds and thus becoming an Undesirable result, are reduced irrigation water supplies for agriculture and for municipal systems through loss of well capacity, loss or degradation of water supplies for smaller community water systems and domestic wells due to well failures, increased energy consumption due to lowered water levels, and the adverse economic consequences of the aforementioned effects such as increased energy usage to extract groundwater from deeper levels." The impacts of lowered groundwater levels on environmental users are not discussed. **Please add**

adverse impacts to environmental users of groundwater to the list of Undesirable Results as presented in this paragraph.

- *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* [Section 3.8 Interconnected Surface Waters Undesirable Results (p. 3-10)] The GSP states (p. 3-10): "No interconnected surface waters have been identified in any Kaweah Subbasin GSAs as described more thoroughly in the basin setting. Thus, criteria were not established." **Once ISWs are analyzed per our comments on Checklist Items 8-10 above, please revise this section, noting any data gaps to be filled.**

<u>Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)</u>

- *[This comment was partially addressed. The need for additional monitoring is noted in Section 4.10.1.1 and 4.10.1.4, but no specific locations or depths are indicated in the Final GSP. These activities are noted to be addressed in future work.]* [Section 4.4 Groundwater Level Monitoring Network (p. 4-9 to 4-14)] Appendix 2A (p. 146) states: "As presented on Figure 19, areas where groundwater is within 50 feet of the ground surface are located along the Kaweah River (Greater Kaweah GSA) and in two areas within the East Kaweah GSA. Notably, these represent areas where groundwater elevations as of the Spring of 2015 has risen to within 50 feet of the ground surface. The indicated areas are preliminary and subject to review of the local GSAs, who know better which areas can be considered Potential GDEs. This can be addressed as part of a further study." However, the monitoring proposed in Chapter 4 does not address this acknowledged data gap. The representative groundwater level monitoring sites shown on Figure 4-3 do not provide adequate coverage of the areas of potential GDEs. **Please address the noted data gap by describing any additional monitoring of locations where potential GDEs occur.**
- *[This comment was partially addressed. The need for additional monitoring is noted in Section 4.10.1.1 and 4.10.1.4, but no specific locations or depths are indicated in the Final GSP. These activities are noted to be addressed in future work.]* [Section 4.8 Depletions of Interconnected Surface Water Monitoring Network (p. 4-17 to 4-18)] Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater *<u>and related surface conditions</u>* (emphasis added). Groundwater level monitoring alone may be insufficient to establish a linkage between groundwater extraction and potentially resulting impacts to environmental resources associated with GDEs and ISWs. The cause-effect relationship between groundwater levels and the biological responses that could result in significant and unreasonable impacts to ISWs and GDEs depends on a number of complex factors, and this relationship is not characterized or discussed. The GSP states (p. 4-18): "As stated previously, current data show that interconnected surface waters are not present in the Kaweah Subbasin due to groundwater levels already being so low. However, to confirm that conditions are not significantly changing in areas with potential GDEs and a depth to groundwater less than 50 ft, groundwater level monitoring shall be implemented along the Kaweah and St. Johns Rivers in the forebay area of the upper reaches." Furthermore, the GSP states (p. 4-21 and 4-22 under Data Gaps): "As part of addressing the data gap of spatial distribution for

SGMA-compliant groundwater level monitoring, the GKGSA and other GSAs of the Kaweah Subbasin will coordinate for the installation of SGMA-compliant groundwater level monitoring to validate existing data and confirm whether or not Interconnected Surface Waters are present in the Kaweah Subbasin in proximity to the Kaweah and St. Johns Rivers."   As noted above, data gaps have also been noted regarding the existence of GDEs. In addition to the need for additional shallow monitoring wells in the upper aquifer to map GDEs, **there is also a need to enhancing monitoring of stream flow and vertical groundwater gradients by installing more stream gauges and clustered/nested wells near streams, rivers or wetlands.** Ideally, co-locating stream gauges with wells that can monitor groundwater levels in both the upper and lower aquifers would enhance understanding about where ISWs exist in the GSA and whether pumping is causing depletions of surface water or impacts on beneficial users of surface water and groundwater. **Please provide sufficient detail for the investigation and monitoring program including stream gauges, screened intervals and frequency of monitoring, in order to describe monitoring of both the extent of ISWs and the quantity of surface water depletions from ISWs.**

- *[No GSP text changes were made in response to our comment.]* [Section 8.1 Annual Reporting Summary to DWR (p. 8-1 to 8-3)] The GSP states (p. 8-3): "Groundwater contour maps submitted during the first five years may reflect a composite of the principal aquifers within the subbasin due to data gaps as discussed in the Basin Setting Report (Appendix 2A) of this Plan. As additional dedicated monitoring wells are installed, and as more knowledge is gained regarding subbasin hydrogeology, groundwater conditions within each separate aquifer will be better understood." **Please discuss the importance of a groundwater elevation map prepared for the Upper Aquifer above the Corcoran Clay**, as that is the only way to determine the appropriate depth relationships between surface water and groundwater which are needed to designate a GDE. Mixing shallow and deep wells, particularly when confined conditions may be present, can be misleading.

<u>Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)</u>

- *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* [Section 7 Projects, Management Actions, and Adaptive Management (p. 7-1)] The GKGSA includes GDEs and ISWs (see our comments under Checklist Items 8-10 and 16-20 above) that are beneficial environmental uses and users of groundwater and may include potentially sensitive resources and protected lands. Environmental beneficial users and uses should be considered in establishing project priorities. In addition, consistent with existing grant and funding guidelines for SGMA-related work, consideration should be given to multi-benefit projects that can address water quantity as well as providing environmental benefits or benefits to disadvantaged communities. **Please include environmental benefits and multiple benefits as criteria for assessing project priorities.**
- *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* [Section 7.2 Projects (p. 7-

1)] This section identifies recharge projects; however, the descriptions of Measurable Objectives for these projects typically identifies benefits to water level, groundwater storage, and degraded water quality but not to interconnected surface waters. In some cases, the water source and the funding have not been identified, increasing the uncertainty of the project being implemented. Because maintenance or recovery of groundwater levels or construction of recharge facilities may have potential environmental benefits, it would be advantageous to demonstrate multiple benefits from a funding and prioritization perspective.

  - **For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.**
  - If ISWs will not be adequately protected by those listed, **please include and describe additional projects and management actions targeted for protecting ISWs.**
  - Recharge basins, reservoirs and facilities for managed stormwater recharge projects can be designed as multi-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such multiple-benefit projects and facilities have been incorporated into local Habitat Conservation Plans (HCPs) and Natural Community Conservation Plans (NCCPs), more fully recognizing the value of the habitat that they provide and the species they support. **For projects that construct recharge basins, please consider identifying if there is habitat value incorporated into the design and how the recharge basins could be managed to benefit environmental users**. Grant and funding priorities for SGMA-related work may be given to multi-benefit projects that can address water quantity as well as provide environmental benefits. **Therefore, please include environmental benefits and multiple benefits as criteria for assessing project priorities.**
  - For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

- *[No GSP text changes were made in response to our comment. It is noted in Attachment E that this will be addressed in future work.]* [Section 7.3 Management Actions (p. 7-52)] The GKGSA has listed possible management actions in Section 7.3 of the GSP. These actions include communication and engagement. **Please consider adding Management Actions which include education and outreach for protection of GDEs and ISWs as well as specific management of these ecosystems and the species they provide for.**

Attachment C

Freshwater Species Located in the Kaweah Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Kaweah Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[5]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[6] as well as on The Nature Conservancy's science website[7].

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Birds				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			

[5] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[6] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[7] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			

Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
		Crustaceans		
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
		Fishes		
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Cottus gulosus	Riffle sculpin		Special	Near-Threatened - Moyle 2013
Lampetra hubbsi	Kern brook lamprey		Special Concern	Vulnerable - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		Special	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		Special Concern	Near-Threatened - Moyle 2013
Mylopharodon conocephalus	Hardhead		Special Concern	Near-Threatened - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013

Herps				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis sirtalis sirtalis	Common Gartersnake			
Insects and Other Invertebrates				
Eulimnichus analis				Not on any status lists
Ischnura barberi	Desert Forktail			
Mammals				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
Mollusks				
Physella virgata	Protean Physa			CS
Plants				
Alnus rhombifolia	White Alder			
Ammannia coccinea	Scarlet Ammannia			
Anemopsis californica	Yerba Mansa			
Azolla filiculoides	NA			
Baccharis glutinosa	NA			Not on any status lists
Bidens laevis	Smooth Bur-marigold			
Carex densa	Dense Sedge			
Cephalanthus occidentalis	Common Buttonbush			
Cyperus acuminatus	Short-point Flatsedge			
Cyperus erythrorhizos	Red-root Flatsedge			
Downingia bella	Hoover's Downingia			

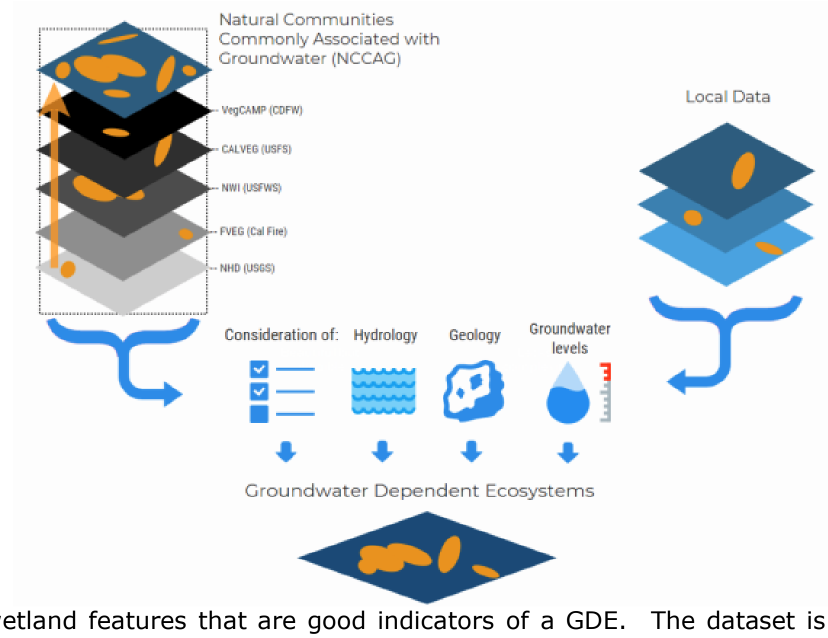
Echinodorus berteroi	Upright Burhead			
Eleocharis macrostachya	Creeping Spikerush			
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium pinnatisectum	Tuolumne Coyote-thistle		Special	CRPR - 1B.2
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle		Special	CRPR - 1B.2
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Lasthenia ferrisiae	Ferris' Goldfields		Special	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lemna minor	Lesser Duckweed			
Ludwigia peploides peploides	NA			Not on any status lists
Marsilea vestita vestita	NA			Not on any status lists
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus guttatus	Common Large Monkeyflower			
Mimulus tricolor	Tricolor Monkeyflower			
Myosurus minimus	NA			
Myriophyllum hippuroides	Western Water-milfoil			
Orcuttia inaequalis	San Joaquin Valley Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Paspalum distichum	Joint Paspalum			
Phyla nodiflora	Common Frog-fruit			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Platanus racemosa	California Sycamore			
Puccinellia simplex	Little Alkali Grass			
Rumex occidentalis				Not on any status lists
Sagina saginoides	Arctic Pearlwort			
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Stachys albens	White-stem Hedge-nettle			
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[8] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[9]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48

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[8] *NC Dataset Online Viewer:* *https://gis.water.ca.gov/app/NCDatasetViewer/*
[9] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[10]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[11] on the Groundwater Resource Hub[12], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[10] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[11] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[12] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

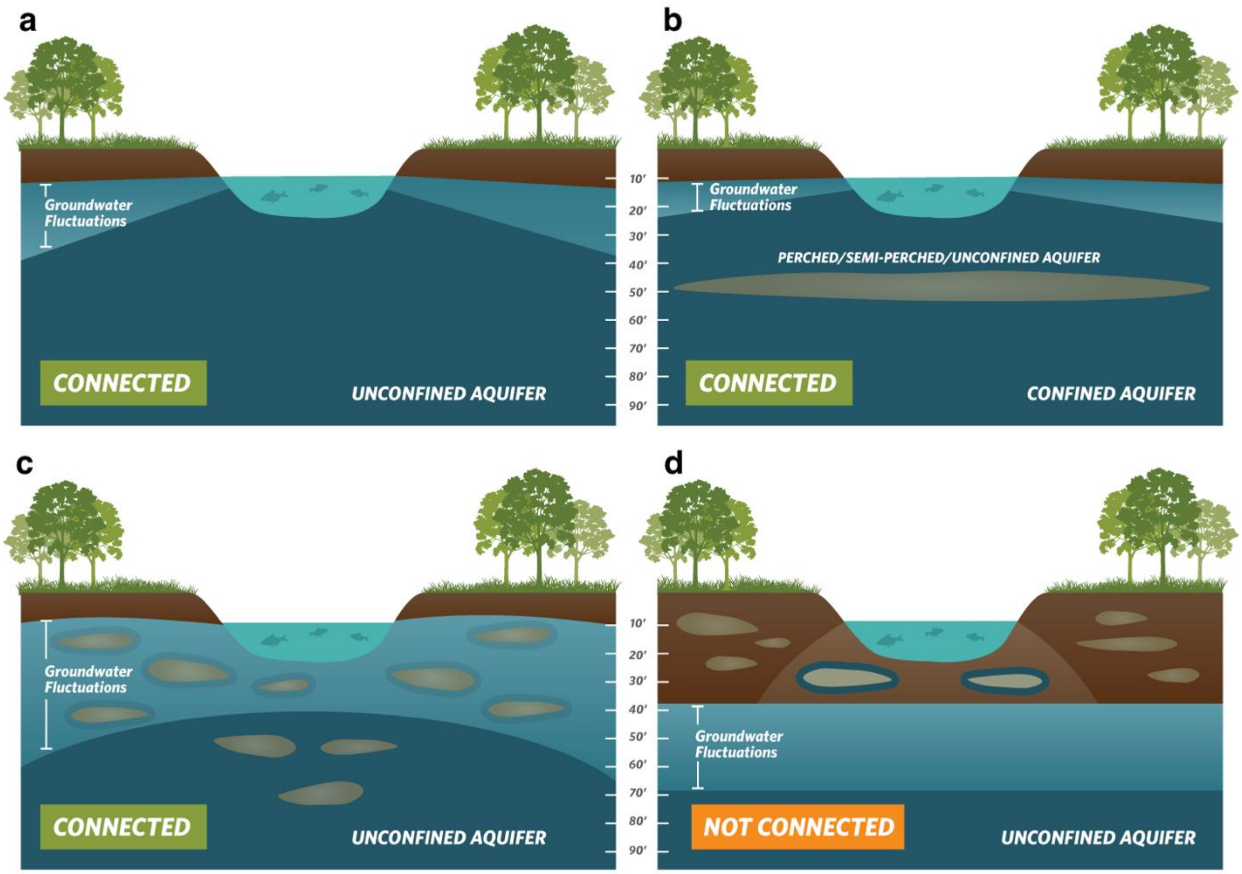

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[13] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[14] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[15] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[16]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

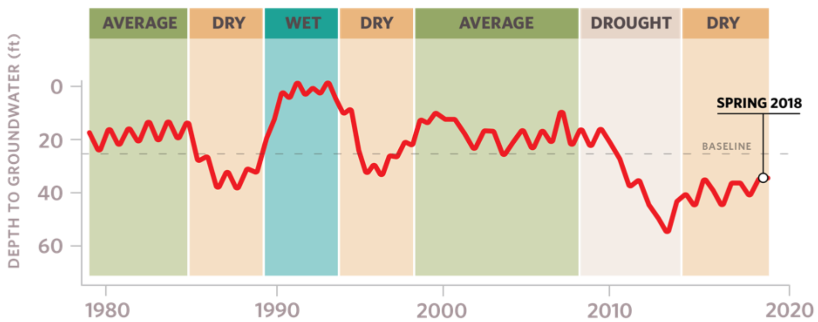

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[13] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[14] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[15] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[16] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[17], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

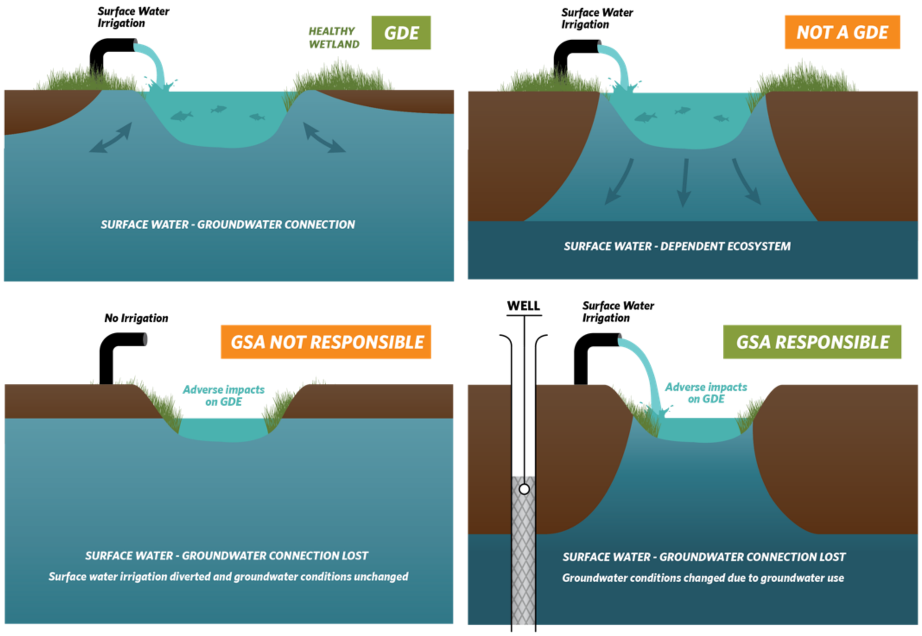

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[17] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

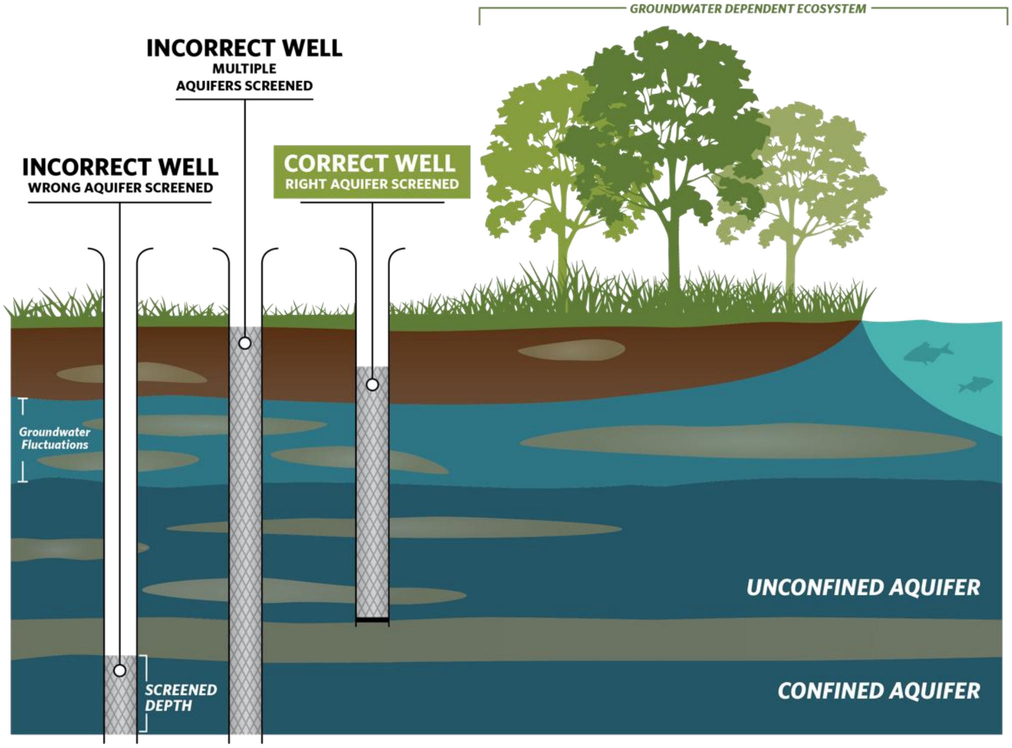

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[18] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

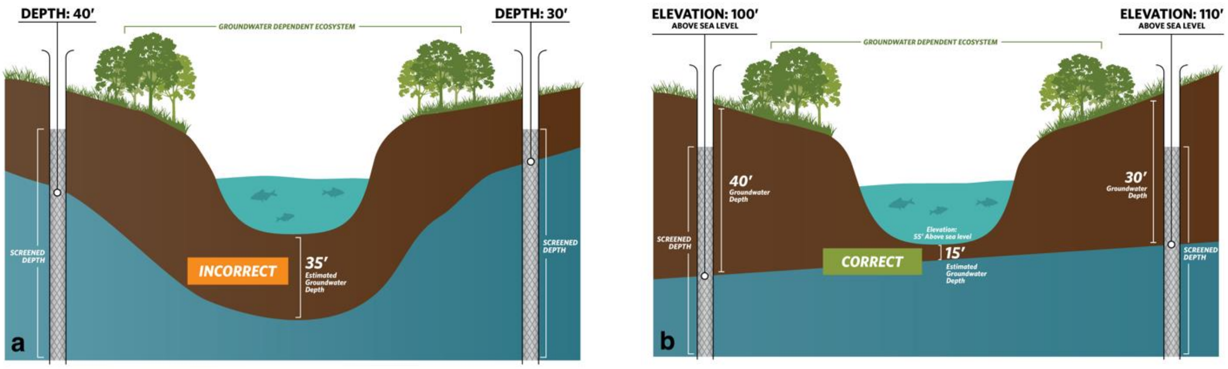

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

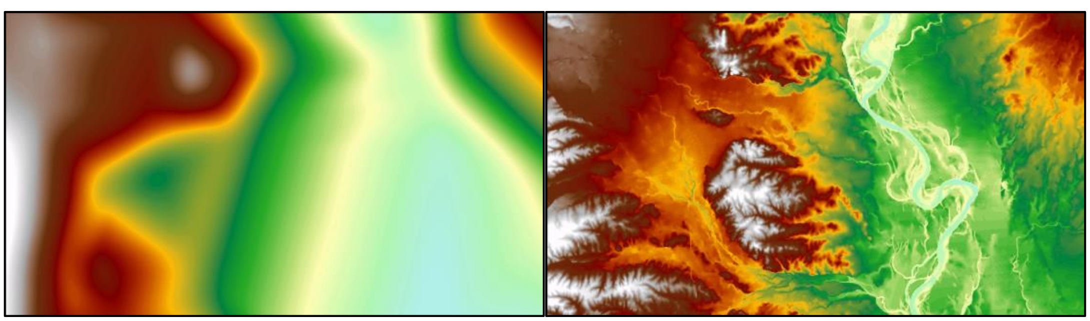

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

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[18] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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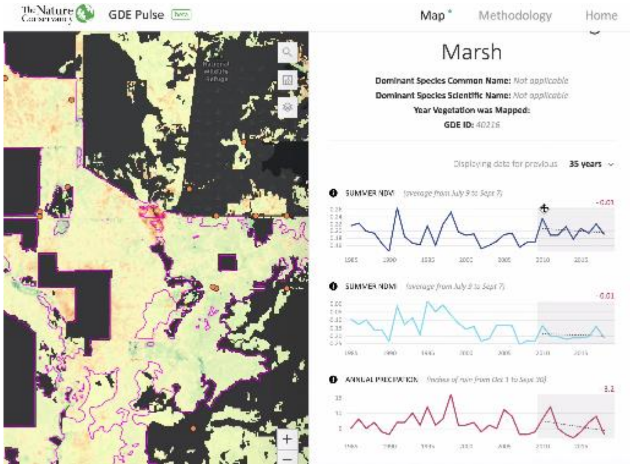
Visit
https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[19]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[20]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

[19] *The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#*

[20] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F

The GSA Response to TNC Comments on the Draft GSP is located on DWR's SGMA portal as Part 2 of 2 of TNC's comments.

Attachment G

Mapping Likely Interconnected Surface Water
The Nature Conservancy, California, May 2020

Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, ISW is defined as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:
The groundwater elevation data, available for Spring 2011-2012, and Spring and Fall 2013-2018, comes from the California Department of Water Resources (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). These data are represented as continuous raster layers that approximates "feet above or below mean sea level" based on groundwater well measurements. According to the documentation online, groundwater level measurements were selected based on measurement date and well construction information (where available) and are intended to approximate the groundwater levels in the unconfined to uppermost semi-confined aquifers. Each of the raster layer has a different extent, but all of them are limited to the Central Valley. To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

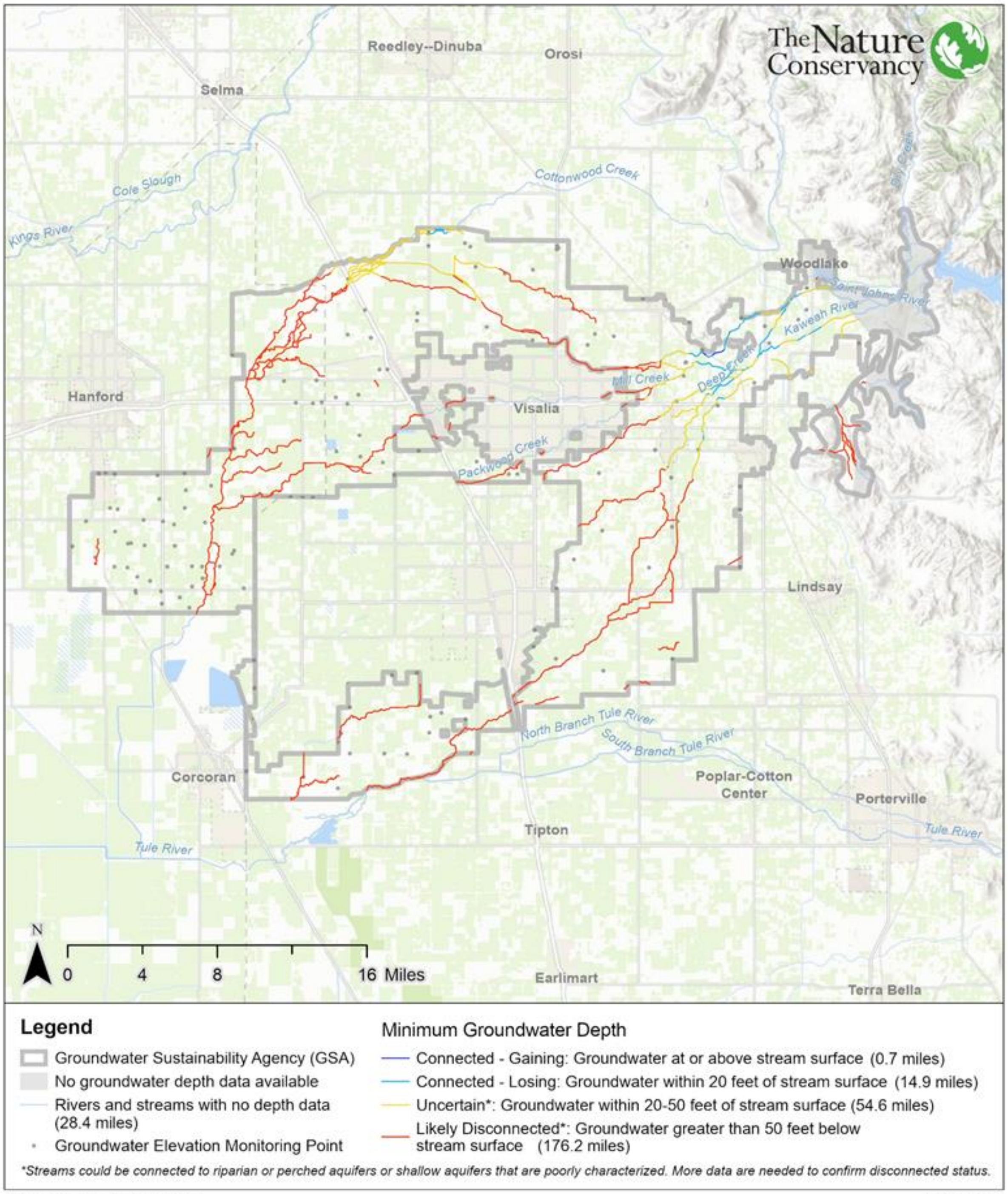
The map splits groundwater depth into four categories:

- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.
- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.

Interconnected Surface Water: Minimum Groundwater Depth (2011-2018)

Greater Kaweah GSA GSP



5-022.11_Kaweah_GreaterKaweah

Data Sources:
CA Dept. of Water Resources Groundwater Elevation Data, gis.water.ca.gov/app/gicima/
NHD Plus V2 Streams, nhdplus.com/NHDPlus/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[21]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[22]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[23] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

[21] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[22] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[23] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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June 3, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Indian Wells Valley Groundwater Sustainability Plan (GSP), Indian Wells Valley Basin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Indian Wells Valley Groundwater Authority's Indian Wells Valley Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing sustainable groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be incomplete in addressing environmental beneficial uses and users.

While the GSP addressed environmental beneficial users in some respects, our review finds that portions of the GSP should be remedied before being approved. Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some case, it may be difficult to address gaps within 180 days. In these cases, we strongly recommend that the Department set clear expectations that these be corrected in the 2025 plan update, and to the degree that gaps are due to lack of data, that these data gaps be addressed to inform the 2025 update.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides the GSA's response to TNC's comments on the Draft GSP.

<u>Our Key Considerations</u>

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section.

We are disappointed to see the feedback that we provided on the draft GSP has been largely ignored in the final plan, as only 5 out of 40 comments were adequately addressed in the Final GSP. This indicates poor engagement of environmental beneficial users, which undermines the intent of SGMA to ensure that sustainability be defined locally with the participation of all users. Based on our experience the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan" (23 CCR §355.4(b)(10)).

<u>TNC recommendation</u>: We strongly recommend that DWR require the GSA to prioritize stakeholder engagement through improvements to their stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters (ISWs) – The GSP incorrectly excluded potential and/or actual ISWs because the plan did not employ the best available science. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). ISWs were excluded based on the ephemeral nature of streams in the valley, yet there is very little description or analysis of the interaction between principal aquifers and surface expression of groundwater. Therefore, potential ISWs are not being managed in the GSP.

<u>TNC recommendation</u>: Until a disconnection can be proven, TNC recommends that the GSP include all potential and confirmed ISWs. We recommend that the GSA conduct a thorough analysis of existing data on groundwater and surface water interconnectivity, and estimate the quantity and timing of streamflow depletions in the subbasin. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 15,021 acres of potential GDEs occur in the GSA boundary. TNC developed the Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

[1] *Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf*

We were pleased to see that GDEs were identified and mapped and presented in the GSP by species type. Additionally, the GSP discusses additional data from the November 2018 field visit and the US Navy mapping of GDEs on NAWS China Lake. Despite these positive steps towards identification of GDEs, the GSP did not adequately consider GDEs as a beneficial user throughout the plan. We recommend that the GSP be revised to consider GDEs as a beneficial user, especially in determining undesirable results, minimum thresholds and measurable objectives.

Water Budget – We would like to commend the GSP for including the groundwater demands of native vegetation in the historical, current and projected water budgets.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

<u>TNC recommendation</u>: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs, including regional springs). In addition, the GSP should confirm that minimum thresholds for ISWs, including regional springs, avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. As a result, the monitoring network does not adequately characterize GDEs and other environmental beneficial users of surface water and groundwater. Potential GDEs are located in areas of the basin where no shallow groundwater monitoring currently exists. While the GSP discusses this data gap, no specific plans for further monitoring are provided. Potential ISWs have also been excluded in the GSP, without proposed monitoring to confirm connectivity, advance mapping, and estimate depletions. Therefore, GDEs and ISWs are not being specifically addressed by the monitoring network in the GSP.

<u>TNC recommendation</u>: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but sustainable groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Indian Wells Valley Groundwater Sustainability Plan

A complete draft of the Indian Wells Valley Groundwater Sustainability Plan (GSP), adopted in January 2020, was reviewed by TNC. Responses to comments are provided in Appendix 1-F of the Final GSP. The response to comments is also provided in Attachment F of this letter. We reviewed the responses to comments and the text of the Final GSP to determine if changes were made to the Final GSP text that addressed TNC's previously submitted comments. This attachment lists our original comments on the complete Public Draft GSP, as submitted to the Indian Wells Valley Groundwater Authority during the public comment period, and states whether or not they were addressed in the Final GSP *[as green text within brackets]*. Comments are provided in the order of the checklist items included as Attachment A.

<u>Checklist Item 1 - Notice & Communication (23 CCR §354.10)</u>

[Section 1.3 Beneficial Uses and Users (p. 1-3 to 1-4)]

- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* We appreciate that the beneficial uses and users of groundwater stated in the GSP include "Environmental (including wildlife habitat and Groundwater Dependent Ecosystems)" (p. 1-4). Users of groundwater, including DACS, SDACs, economically distressed areas, businesses, large and small-scale agriculture, domestic users, federal, state and local agencies, tribal groups, non-profit organizations, community organizations, and environmental groups, were identified during the development of the GSP. The listing of over 150 stakeholders is included as Appendix 1-D, and the Communications & Engagement Plan is provided in Appendix 1-E. **Please identify whether or not the following beneficial uses and users of groundwater are present: Protected Lands, including refuges, conservation areas, and recreational areas; and Public Trust Uses, including wildlife, aquatic habitat, fisheries, and recreation.**
- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* The types and locations of environmental uses, species and habitats supported, instream flow requirements, and other designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the Basin should be specified. **To identify environmental users, please refer to the following:**
    - The NC Dataset (https://gis.water.ca.gov/app/NCDatasetViewer/) which identifies potential presence of groundwater dependent ecosystems in this basin.

- The list of freshwater species located in the Indian Wells Valley Basin in Attachment C of this letter. Please take particular note of the species with protected status.
- CDFW's California Natural Diversity Database (CNDDB) - https://www.wildlife.ca.gov/Data/CNDDB
- USFWS's IPAC report for the Indian Wells Valley Area, if available - https://ecos.fws.gov/ipac/

Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8)

[Section 2.5.2 Summary of General Plans and Other Land Use Plans (p. 2-15 to 2-24)]

- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* The Kern, Inyo and San Bernardino Counties General Plans were adopted prior to the development of the Indian Wells Valley Groundwater Authority. The provided summaries of the plans emphasize policies that relate to water supply and groundwater, but do not include discussion of goals and policies related to the protection and management of GDEs that could be affected by groundwater withdrawals. **Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of aquatic habitats and other environmental users.**

[Section 2.6 Existing Water Resources Monitoring Programs (p. 2-25 to 2-27)]

- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* Locations of monitoring wells in the IWV Groundwater Basin are shown on Figure 2-13, but there is no listing of well attributes such as screened interval or well depth. **Please provide a table with well construction information for the wells currently monitored.**

[Section 2.7.7 Well Permitting and Procedures (p. 2-38 to 2-42]

- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* Well permitting is handled by Kern, Inyo, and San Bernardino counties, the three counties that encompass the basin. **Please include a discussion of how future well permitting will be coordinated with the GSP to assure achievement of the Plan's sustainability goals.**
- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF vs. SWRCB and Siskiyou County, No. C083239). **Compliance of well permitting programs with this requirement should be stated in the GSP.**

Checklist Items 5, 6, and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 3.3.1 Geology and Hydrogeology (p. 3-7 to 3-9)]

- *[The GSA's response states: "Additional data is needed and will be addressed as a data gap when implementing the GSP." However, this data gap is neither described in the GSP nor filled by proposed monitoring plans.]* The GSP describes two principal aquifers on p. 3-9, the shallow aquifer and deeper aquifer. The GSP describes a strong connection between the two aquifers in portions of the Basin, with confinement or artesian conditions in other areas of the Basin. The GSP also describes springs and seeps on p. 3-14. However, the GSP does not clearly describe the hydrologic dynamics between surface expressions of groundwater (springs and seeps) and the two principle aquifers. The basin-wide cross sections provided in Figures 3-5a & 3-5b are regional and do not include a graphical representation of the manner in which shallow groundwater may interact with GDEs, nor does the HCM shown on Figure 3-3. **Please include further description and/or an example near-surface cross section that depicts the conceptual understanding of hydrologic dynamics that govern communication between the principal aquifers and surface expressions of groundwater.**
- *[The GSA's response states: "Additional data is needed and will be addressed as a data gap when implementing the GSP." However, this data gap is neither described in the GSP nor filled by proposed monitoring plans.]* The GSP states (p. 3-8): "For the GSP, the groundwater depletion that is of concern in the IWVGB is from the water in unconsolidated alluvial deposits. These water-bearing sediments store and transmit water and are divided into the following hydrostratigraphic features that are important for analyzing sustainability criteria and groundwater budgets." **Please include a discussion of the basin bottom in this section.** As noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should be included in the determination of the basin bottom.** Properly defining the bottom of the basin will prevent the possibility of extractors with wells deeper than the basin boundary from claiming exemption from SGMA due to their well residing outside the vertical extent of the basin boundary.

Checklist Items 8, 9, and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)

[Section 3.3.3.2 Streamflow and Mountain Front Recharge (p. 3-12 to 3-14)]
[Section 3.4.6 Interconnected Surface Water Systems (p. 3-34)]
[Section 4.3.5 Depletions of Interconnected Surface Water Undesirable Results (p. 4-15)]

- *[The GSA's response states "Comment addressed in Sections 4.3 and 4.3.5. Additional data is needed and will be addressed as a data gap when implementing the GSP. The IWVGA will reevaluate the need to establish sustainability criteria for interconnected surfaced water and GDEs as data gaps are filled." Thank you for acknowledging the importance of filling this data gap with future monitoring. However, please see our below recommendations for further analysis of ISWs which* *would help define specific future monitoring needs.]* The GSP states (p. 3-14): "There are no significant interconnected surface water systems which interact with groundwater in IWVGB" and goes on to state (p. 3-33): "Streams in the valley are typically ephemeral and the majority of recharge occurs as mountain front recharge. Additionally, there are multiple natural springs in the mountain and canyon areas surrounding the IWV (see Figure 3-11)." However, p. 4-15 states: "Groundwater is critical to sustaining springs, wetlands, and perennial flow (baseflow) in streams as well as to sustaining vegetation such as phreatophytes that directly tap groundwater." The GSP dismisses ISWs due to the ephemeral nature of streams in the valley, yet as noted above in the comments for Checklist Items 5-7, there is very little description of the interaction between principle aquifers and surface expression of groundwater. Without further documented evidence, ISWs should be retained for the consideration of sustainable management criteria. **This section of the GSP could be improved by providing further analysis of ISWs. Please note the following best practices for analyzing ISWs provided in the subsequent bullets.**

- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* ISWs are best estimated by first determining which reaches are completely disconnected from groundwater. This approach would involve comparing groundwater elevations with a land surface Digital Elevation Model that could identify which surface waters have groundwater consistently below surface water features, such that an unsaturated zone would separate surface water from groundwater. **Please evaluate stream reaches with depth to groundwater contour maps (please see Attachment D for best practices for completing this step). Please reconcile any data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP to improve ISW mapping.**
- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. **Please provide a cross-section and/or corresponding hydrographs to show the relationship between the stream channels and the depth to groundwater at wells near the stream.**

<u>Checklist Items 11 to 15, Identifying and Mapping GDEs (23 CCR §354.16)</u>

[Section 3.4.7 Groundwater-Dependent Ecosystems (GDEs) (p. 3-35)]

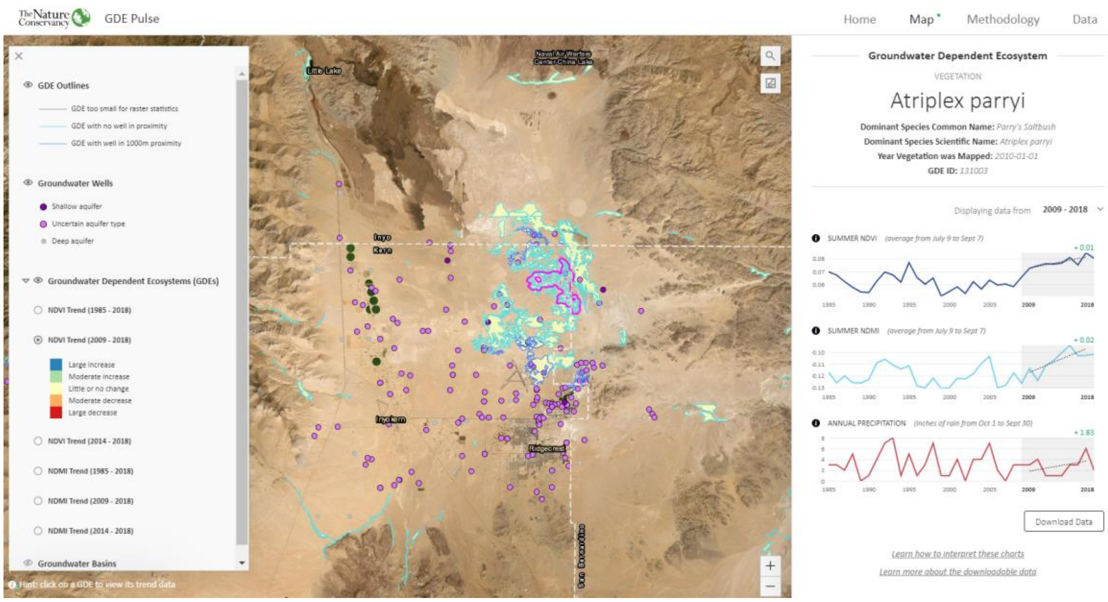
- *[No response required.]* TNC acknowledges and applauds IWVGA for the use of the NC dataset, as mapped on Figure 3-16. We also appreciate the inclusion of species type on Figure 3-16. The following suggestions could be used to clarify the analysis of the presence of potential GDEs in the Basin.

- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* The NC dataset is a starting point for GSAs to identify GDEs in their basin. **Please map the original NC dataset, and clearly document which polygons were added (and what local sources were used to identify them), removed (and the removal reason), and kept (from the original NC dataset)**. The basin's GDE shapefile, which is submitted via the SGMA Portal, should also include two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were added or removed). **Please clarify what the legend on Figure 3-16 means by "Not Applicable". If this represents a removed GDE Unit, please state the removal reason.**
- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* **Please provide one map to denote the most accurate picture of potential GDEs in the Basin showing the source of the data. For example, please note if any GDEs were added or removed based on the November 2018 field visit. Additionally, note if any GDEs were added or removed based on the US Navy mapping of GDEs on NAWS China Lake.**
- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* **On the final map figure, please use more easily distinguishable colors or patterns to distinguish the GDE Units from one another.**

<u>Checklist Items 16 to 20, Describing GDEs (23 CCR §354.16)</u>

[Section 3.4.7 Groundwater-Dependent Ecosystems (GDEs) (p. 3-35)]

- *[A reference to GDE Pulse was added to the GSP text. Thank you for citing TNC's resource for information on GDE health and groundwater conditions. The GSP could be further improved by adding further information from GDE Pulse, such as figures or text describing how this tool can be used for further analysis of GDEs over the GSP implementation period.]* **Please provide information on the historical or current groundwater conditions in the GDEs or the ecological conditions present**. Refer to GDE Pulse (https://gde.codefornature.org; See Attachment E of this letter for more details) or any other locally available data to describe depth to groundwater trends in and around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in the Indian Wells Valley Basin:



- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* **Please identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat are located in or near any of the GDEs, since some organisms rely on uplands and wetlands during different stages of their lifecycle**. Resources for this include the list of freshwater species located in the Indian Wells Valley Basin that can be found in Attachment C of this letter, the Critical Species Lookbook, and CDFW's CNDDB database. For example, please note where the endangered Mohave Tui Chub are located in reference to the GDE units.

<u>Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)</u>

[Section 3.3.4 Water Budget and Overdraft Conditions (p. 3-15 to 3-25)]

- *[The GSA's response addresses our comment and appropriate GSP text changes were made. Thank you for clarifying outflow terms in the water budget.]* The GSP states (p. 3-20): "DRI performed a hydraulic analysis of the Salt Wells Valley and concluded that it is possible that currently approximately 50 AFY of the groundwater flow in the Salt Wells Valley originates as underflow from the IWV as distinguished from mountain front recharge from the Argus Range." The historical average budget in Table 3-6 shows the interbasin outflow as 60 AFY, while in the current budget in Table 3-7 the interbasin outflow is 50 AFY. **Please clarify the basis for the estimated amounts of interbasin outflow in the historical and current water budgets.**
- *[The GSA's response addresses our comment and appropriate GSP text changes were made. Thank you for clarifying how ET was calculated in the water budget.]* The current estimate of evapotranspiration (ET) in the basin is given as 4,850 ac-ft/yr (Table 3-7). The ET of saltgrass, pickleweed, greasewood and bare playa are discussed individually, but the basis of the total estimated evapotranspiration is not

provided. **Please clarify how the total ET was calculated in the current water budget.**

- *[The GSA's response addresses our comment and appropriate GSP text changes were made. Thank you for clarifying which water budget is baseline without the projects and management actions.]* The projected water budgets were simulated for the years 2035, 2040, and 2070 using the IWV groundwater model (Pohlman et al, 2019) with the projects and management actions implemented. The future budgets are shown in Table 3-8 with a new term Artificial Recharge included, representing the recharge by the projects and management actions. **In addition to the Predicted Water Budgets with Projects shown, please provide a baseline future budget without the projects and management actions.**
- *[The GSA's response: "See Section 3.5.6" does not address our comment and no changes to the GSP text were made.]* It appears that climate change was not considered in the projected water budgets. The GSP states (p. 3-48): "DRI (McGraw et al, 2016) examined the predicted precipitation quantities for several published IPCC climate models and documented conflicting results; ie, some models predicted decreases and some predicted increases in precipitation in the future with the assumed driver of CO2 increase. This GSP does not incorporate any precipitation change in model simulations into the future other than annual fluctuations similar to those that have been observed in the past record." The regulations [23 CCR §354.18(e)] state that "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow" (p. 12 of DWR BMP for Water Budgets[2]). DWR's Guidance for Climate Change Data[3] is intended as a source of guidance for climate change factors. **Please further elaborate on the decision to not consider climate change in the projected water budget considering the regulations and DWR guidance. Please further describe the methodology for future precipitation that was employed.**

Checklist Items 23 to 25 – Sustainability Goal (23 CCR §354.24)

[Section 4.2 Sustainability Goal (p. 4-2)]

- *[The GSA's response states: "Comment noted. Environmental beneficial uses and users are recognized as part of the community." GSP text changes were not made however.]* The GSP states the Sustainability Goal as (p. 4-3): "The sustainability goal is to manage and preserve the IWVGB groundwater resource as a sustainable water supply. To the greatest extent possible, the goal is to preserve the character of the community, preserve the quality of life of IWV residents, and sustain the mission at

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[2] DWR Best Management Practice for Water Budgets. https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents

[3] DWR Guidance for Climate Change Data Use During GSP Development: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Climate-Change-Guidance-Final_ay_19.pdf

NAWS China Lake." There is no mention of environmental users or uses (GDEs and ISWs) in the Sustainability Goal. **Since GDEs are present in the Subbasin, they should be recognized as beneficial users of groundwater and should be included in the Sustainability Goal.**

Checklist Items 26-29 – Measurable Objectives (23 CCR §354.30) and Minimum Thresholds (23 CCR §354.28)

[Sections 4.4.2 Chronic Lowering of Groundwater Levels Minimum Threshold (p. 4-19)]
[Sections 4.5.2 Chronic Lowering of Groundwater Levels Measurable Objective and Interim Milestones (p. 4-32)]

- *[The GSA's response states: "Revisions made to Section 4.3 and Section 4.3.5." However, these revisions only state that IWVGA will reevaluate the need to establish sustainability criteria for interconnected surfaced water and GDEs as data gaps are filled. The plan proposes further reductions in groundwater storage and water levels until projects can alleviate further water groundwater overdrafting. This may well cause the reduction or elimination of groundwater dependent ecosystems. This issue must be analyzed and addressed in the plan.*] This Minimum Threshold and Measurable Objective do not consider GDEs. Because GDEs rely on shallow groundwater, further groundwater monitoring in the shallow zone is necessary to determine potential effects on GDEs. The representative monitoring sites for chronic lowering of groundwater level SMC are wells that monitor the deeper aquifer and thus do not monitor potential effects on GDEs. **Please include GDEs in these sections and state whether the minimum thresholds, measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Sections 4.4.3 Degraded Water Quality Minimum Threshold (p. 4-24)]
[Sections 4.5.3 Degraded Water Quality Measurable Objective and Interim Milestones (p. 4-32)]

- *[The GSA's response states: "Revisions made to Section 4.3 and Section 4.3.5." However, these revisions only state that IWVGA will reevaluate the need to establish sustainability criteria for interconnected surfaced water and GDEs as data gaps are filled. Our comment was not addressed.]* This Minimum Threshold and Measurable Objective do not consider the water quality needs of GDEs. As previously stated, because GDEs rely on shallow groundwater, further groundwater monitoring in the shallow zone is necessary to determine potential effects on GDEs. The representative monitoring sites for degraded water quality SMC are wells that monitor the deeper aquifer and thus do not monitor potential effects on GDEs. **Please include a discussion about GDEs and water quality and state whether the minimum thresholds, measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to environmental users and uses of groundwater.**

Checklist Item 30-46 – Undesirable Results (23 CCR §354.26)

[Section 4.3.2 Chronic Lowering of Groundwater Levels Undesirable Results (p. 4-11)]

- *[The GSA's response states: "Revisions made to Section 4.3 and Section 4.3.5." However, these revisions only state that IWVGA will reevaluate the need to establish sustainability criteria for interconnected surfaced water and GDEs as data gaps are filled. Our comment was not addressed.]* This section only describes potential effects relating to human beneficial uses of groundwater and neglects environmental beneficial uses that could be adversely affected by chronic groundwater level decline. **Please add "potential adverse impacts to environmental uses and users" to the list of potential effects presented in Section 4.3.2.3.**
- *[The GSA's response states: "Additional data is needed and will be addressed as a data gap when implementing the GSP." However, this data gap is neither adequately described in the GSP nor filled by proposed monitoring plans.]* This section refers to the shallow well impact analysis in Appendix 3E and states that the number of shallow wells that would be impacted if the proposed projects and management actions are implemented is estimated to be 22, which IWVGA considers a feasible number of wells that can be mitigated. GDEs, however, are not considered in this analysis. Damage to GDEs can occur within a relatively short period of time and can be irreversible, leading to the permanent loss of an environmental resource. **Please elaborate on how the criteria for determining Undesirable Results would be applied in a way that is protective of significant and unreasonable harm to GDEs. A triggering procedure could be included for violation of minimum thresholds that includes early identification of potential GDE impacts and appropriate response actions. This could be accomplished efficiently and cost-effectively using remote sensing tools, such as GDE Pulse. Refer to Appendix E of this letter for an overview of GDE Pulse, an online tool for monitoring the health of GDEs over time.**
- *[The GSA's response states: "Additional data is needed and will be addressed as a data gap when implementing the GSP." However, this data gap is neither adequately described in the GSP nor filled by proposed monitoring plans.]* **Please provide more specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs.** The definition of 'significant and unreasonable' is a qualitative statement that is used to describe when undesirable results would occur in the basin, such that a minimum threshold can be quantified. Potential effects on all beneficial users of groundwater in the basin need to be taken into consideration. According to the California Constitution Article X, §2, water resources in California must be "put to beneficial use to the fullest extent of which they are capable". **Please identify appropriate biological indicators that can be used to monitor potential impacts to environmental beneficial users due to groundwater conditions. Refer to Appendix E of this letter for an overview of GDE Pulse, an online tool for monitoring the health of GDEs over time.**

[Section 4.3.3 Degraded Water Quality Undesirable Results (p. 4-12)]

- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* This section only describes potential effects relating to human beneficial uses of groundwater and neglects environmental beneficial uses that could be adversely affected by degraded water quality. **Please add "potential adverse impacts to environmental uses and users" to the list of potential effects presented in Section 4.3.3.3.**

[Section 4.3.5 Depletions of Interconnected Surface Water Undesirable Results (p. 4-14)]

- *[The GSA's response is: "Revisions made to Section 4.3 and Section 4.3.5. The IWVGA will reevaluate the need to establish sustainability criteria for interconnected surfaced water and GDEs as data gaps are filled." Very little analysis of ISWs is provided in the GSP, nor are data gaps or plans to fill them adequately described. Our comment was not addressed.]* GDEs are often adjacent to streams or associated with riparian corridors where ISWs exist, even if only seasonally or are discontinuous along a longitudinal profile. ISWs that are not continuously connected spatially and/or temporally are still ISWs and should not be excluded from this GSP. The regulations [23 CCR §351(o)] define interconnected surface waters as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". **Please include ISWs in the Sustainable Management Criteria and state how they will help achieve the Sustainability Goal as it pertains to the environment.**
- *[The GSA's response is: "Revisions made to Section 4.3 and Section 4.3.5." However, these revisions only state that IWVGA will reevaluate the need to establish sustainability criteria for interconnected surfaced water and GDEs as data gaps are filled. Please include further analysis for potential depletion of ISWs. It is critically important that the plan include steps to determine whether regional springs could be affected by reductions in groundwater levels.]* The GSP states (p. 4-15): "Groundwater is critical to sustaining springs, wetlands, and perennial flow (baseflow) in streams as well as to sustaining vegetation such as phreatophytes that directly tap groundwater." It further states (p. 4-15): "Due to limited data on the relationship of interconnected surface water (springs) to GDEs and GDE's direct use of groundwater, no additional sustainable management criteria are proposed at this time." This section does not consider Undesirable Results for Interconnected Surface Water systems. **Even though data is lacking on ISWs, they should be included in the Sustainable Management Criteria and Undesirable Results. The analysis for potential depletion of ISWs should include beneficial users of surface water that could be affected by groundwater withdrawals, including environmental users. Please discuss the data gap for ISWs in the Monitoring Network section of the GSP and discuss future plans to fill the data gap. Possible monitoring could include shallow monitoring wells, stream gauges, and nested/clustered wells along surface water features to improve ISW mapping.**

<u>Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)</u>

[Section 4.7.1 Proposed Monitoring Network and Schedule (p. 4-36 to 4-37)]

- *[The GSA's response states: "Comment noted. See Section 3.6.1.4 and 4.3.5. Additional data is needed and will be addressed as a data gap when implementing the GSP." However very little description is provided in these sections. Please further elaborate on the GDE monitoring program.]* The GSP states (p. 4-15): "Specifics regarding the relationship between groundwater levels and the health of GDEs is currently not known, including extinction root depths, and there is no current monitoring program to track GDE health; therefore, GDE monitoring, currently a data gap, is proposed as part of the GSP monitoring program." However, this monitoring is not described in Section 4.7. **Please describe the GDE monitoring program and address how the need to link and correlate groundwater level declines to biological responses and significant and adverse impacts to GDEs and ISWs will be addressed by the monitoring program.**
- *[This comment was omitted from the response to comments document. No GSP text changes were made.]* Section 4.7.1 states that wells to monitor water levels near the GDEs will be added to the monitoring program, however no further details are provided. **For adequate characterization of groundwater conditions near GDE Units, please provide a detailed plan for filling this data gap. Please propose the locations of wells near GDE Units, the screened interval, and the schedule for installation.**
- *[The GSA's response states: "Additional data is needed and will be addressed as a data gap when implementing the GSP." However, this data gap is neither adequately described in the GSP nor filled by proposed monitoring plans.]* The GSP states (p. 3-50): "Data gaps in the groundwater level monitoring program exist outside of the pumping areas. There are only a few monitoring wells in the El Paso area, mostly open space managed by BLM. Groundwater resources in this area have not been fully characterized or quantified. The largest ephemeral stream system in IWV commences from this area in Freeman and Little Dixie Washes. Additional well drilling to characterize the aquifer structure and properties, and groundwater level monitoring could provide a better understanding of the occurrence and movement of water in this area." **Please discuss this data gap in the Monitoring Network section of the GSP and discuss future plans to fill this data gap. Possible monitoring could include shallow monitoring wells, stream gauges, and nested/clustered wells along surface water features to improve ISW mapping.**
- *[The GSA's response states: "Additional data is needed and will be addressed as a data gap when implementing the GSP." However, this data gap is neither adequately described in the GSP nor filled by proposed monitoring plans.]* The GSP states (p. 4-36): "The existing groundwater level monitoring network is very robust for establishing changes in groundwater levels over time throughout the Indian Wells Valley basin and will continue throughout the planning horizon. As discussed in Section 3.6, depth to water is, and will continue to be, measured biannually at 198 wells during Spring (March) and Fall (October) to observe seasonal changes in groundwater levels. Water levels measured at these wells will also be used to determine the change of storage in the Basin annually." The ten proposed representative wells to be used for monitoring groundwater levels, shown in Figure

4-2 and listed in Table 4-1, are predominantly deep wells which will not adequately monitor impacts to GDEs. **Please expand the shallow groundwater monitoring network through shallow and/or nested wells to further understand the potential for GDEs to be supported by shallow groundwater or upward vertical gradients that produce surface expression of groundwater in the form of springs and seeps. If existing wells cannot be used to monitor the shallow aquifer, propose installing new wells.**

- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* The GSP states (p. 3-49): "Ten multi-level monitoring wells provide vertical gradients of groundwater flow, identifying some of the recharge and discharge areas within the Basin." **Please show the location of these wells on a map and present the well hydrographs, along with an analysis of the vertical gradients that can be determined from the data.**

Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)

[Section 5. Projects and Management Actions (p. 5-1)]

- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* We appreciate that the IWVGB includes GDEs that are beneficial environmental uses and users of groundwater. To strengthen management of environmental beneficial users and uses, they should be considered in establishing project priorities. In addition, consistent with existing grant and funding guidelines for SGMA-related work, consideration should be given to multi-benefit projects that can address water quantity as well as providing environmental benefits or benefits to disadvantaged communities. **Please include environmental benefits and multiple benefits as criteria for assessing project priorities. For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.**
- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* Recharge basins, reservoirs and facilities for managed stormwater recharge projects can be designed as multi-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such multiple-benefit projects and facilities have been incorporated into local Habitat Conservation Plans (HCPs) and Natural Community Conservation Plans (NCCPs), more fully recognizing the value of the habitat that they provide and the species they support. **For projects that construct recharge basins, please consider identifying if there is habitat value incorporated into the design and how the recharge basins could be managed to benefit environmental users**. Grant and funding priorities for SGMA-related work may be given to multi-benefit projects that can address water quantity as well as provide environmental benefits. **Therefore, please include environmental benefits and multiple benefits as criteria for assessing project priorities.**

- *[No response needed.]* For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

[Section 5.2.1 Management Action No. 1: Implement Annual Pumping Allocation Plan, Transient Pool and Fallowing Program (p. 5-4 to 5-13)]

- *[The GSA's response: "Revisions made to Section 4.3 and Section 4.3.5" does not address our comment and no changes to the GSP text were made.]* The IWVGA proposes an Annual Allocation Plan, Transient Pool and Fallowing Program to address the critical overdraft in the Basin. "The IWVB does not have the legal authority to restrict, assess, or regulate production for NAWS China Lake, therefore NAWS China Lake groundwater production is considered highest of beneficial use" (p. 5-10). "Implementation of the Annual Pumping Allocation Plan, Transient Pool and Fallowing Program may be subject to environmental regulations and could require the preparation of environmental studies. The IWVGA will follow all regulatory requirements associated with the environmental processes including public noticing and review requirements" (p. 5-11). **Please include environmental users in the list of beneficial uses of groundwater on p. 5-10 and describe how GDEs will be protected after this management action is implemented.**

[Section 5.3.1 Project No. 1 Develop Imported Water Supply (p. 5-13 to 5-22)]

- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made. Given the scarcity of available surface water supplies, please also include an analysis of the impacts on groundwater dependent ecosystems pending acquisition of water imports, given accompanying reduction in groundwater storage and lowering of water levels.]* The IWVGA is considering two options for importing water into the Basin, thereby reducing reliance on groundwater. Project benefits include increasing groundwater levels and groundwater storage, improved water quality, and reduced land subsidence, however there is no mention of potential environmental benefits. **Please state what environmental benefits or detriments would accrue from this project.**

[Section 5.3.2 Project No. 2 Optimize Use of Recycled Water (p. 5-23 to 5-33)]

- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* Two projects have been proposed to increase the quantity of recycled water at the City of Ridgefield treated wastewater and use it for landscaping at several locations shown in Figure 5-3 and 5-4. The purpose of these projects is to replace use of groundwater with use of non-potable recycled water, benefitting groundwater levels and storage. However, the recycled water currently benefits the Tui Chub habitat. Increased use of recycled water for other purposes would decrease return flows that are a significant source of water for Tui Chub habitat. **Please describe how the habitat of the Tui Chub will be protected if this project is implemented.**

[Section 5.4.3 Additional Projects (p. 5-52)]

- *[The GSA's response "Comment noted" does not address our comment and no changes to the GSP text were made.]* The GSP states (5-52): "The IWVGA is taking an adaptive management approach to IWVGB management over the planning horizon. Consequently, potential projects and management actions will continuously be considered and evaluated over the planning horizon to ensure that the most beneficial and economically feasible projects and management actions are implemented to reach sustainability in the IWVGB." **Please discuss the protection of environmental users and environmental benefits in the evaluation process.**

Attachment C

Freshwater Species Located in the Indian Wells Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Indian Wells Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[4]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[5] as well as on TNC's science website[6].

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Birds				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	

[4] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[5] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[6] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oreothlypis luciae	Lucy's Warbler		Special Concern	BSSC - Third priority
Oxyura jamaicensis	Ruddy Duck			

Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Rynchops niger	Black Skimmer			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
Crustaceans				
Branchinecta gigas	Giant Fairy Shrimp			
Fishes				
Siphatales mohavensis	Mojave tui chub	Endangered	Endangered	Endangered - Moyle 2013
Herps				
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus punctatus	Red-spotted Toad			
Thamnophis couchii	Sierra Gartersnake			
Insects and Other Invertebrates				
Argia vivida	Vivid Dancer			
Ischnura barberi	Desert Forktail			
Libellula composita	Bleached Skimmer			
Sympetrum corruptum	Variegated Meadowhawk			
Plants				
Alnus rhombifolia	White Alder			
Amphiscirpus nevadensis				Not on any status lists

Anemopsis californica	Yerba Mansa			
Baccharis salicina				Not on any status lists
Berula erecta	Wild Parsnip			
Eleocharis parishii	Parish's Spikerush			
Hosackia oblongifolia	NA			1.B.3
Juncus dubius	Mariposa Rush			
Juncus rugulosus	Wrinkled Rush			
Juncus xiphioides	Iris-leaf Rush			
Mimulus guttatus	Common Large Monkeyflower			
Phacelia distans	NA			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Schoenoplectus pungens longispicatus	Three-square Bulrush			
Stachys albens	White-stem Hedge-nettle			
Typha domingensis	Southern Cattail			
Veronica anagallis-aquatica	NA			
Notes: ARSSC = At-Risk Species of Special Concern BCC = Bird of Conservation Concern BSSC = Bird Species of Special Concern CRPR = California Rare Plant Rank CS = Currently Stable IUCN = International Union for Conservation of Nature SSC = Species of Special Concern				

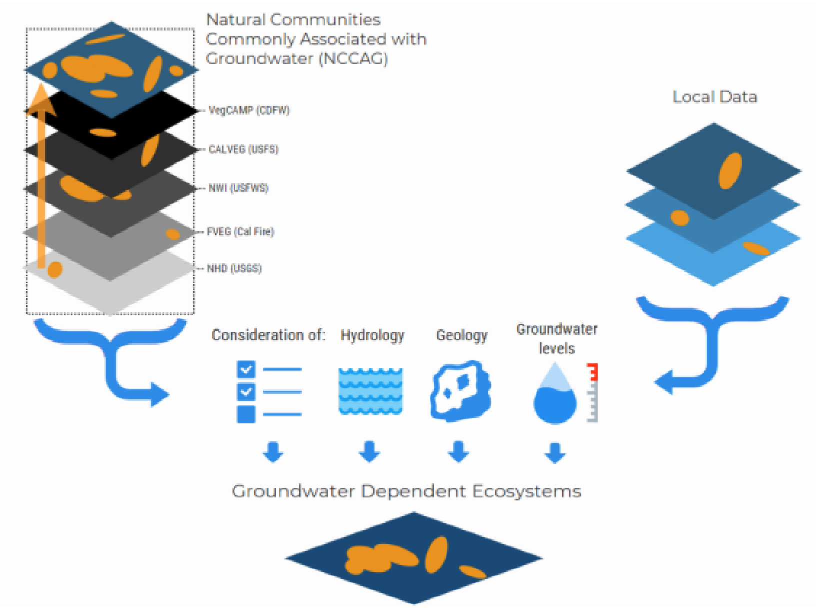
Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[7] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[8]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48

[7] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[8] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[9]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[10] on the Groundwater Resource Hub[11], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[9] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[10] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[11] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

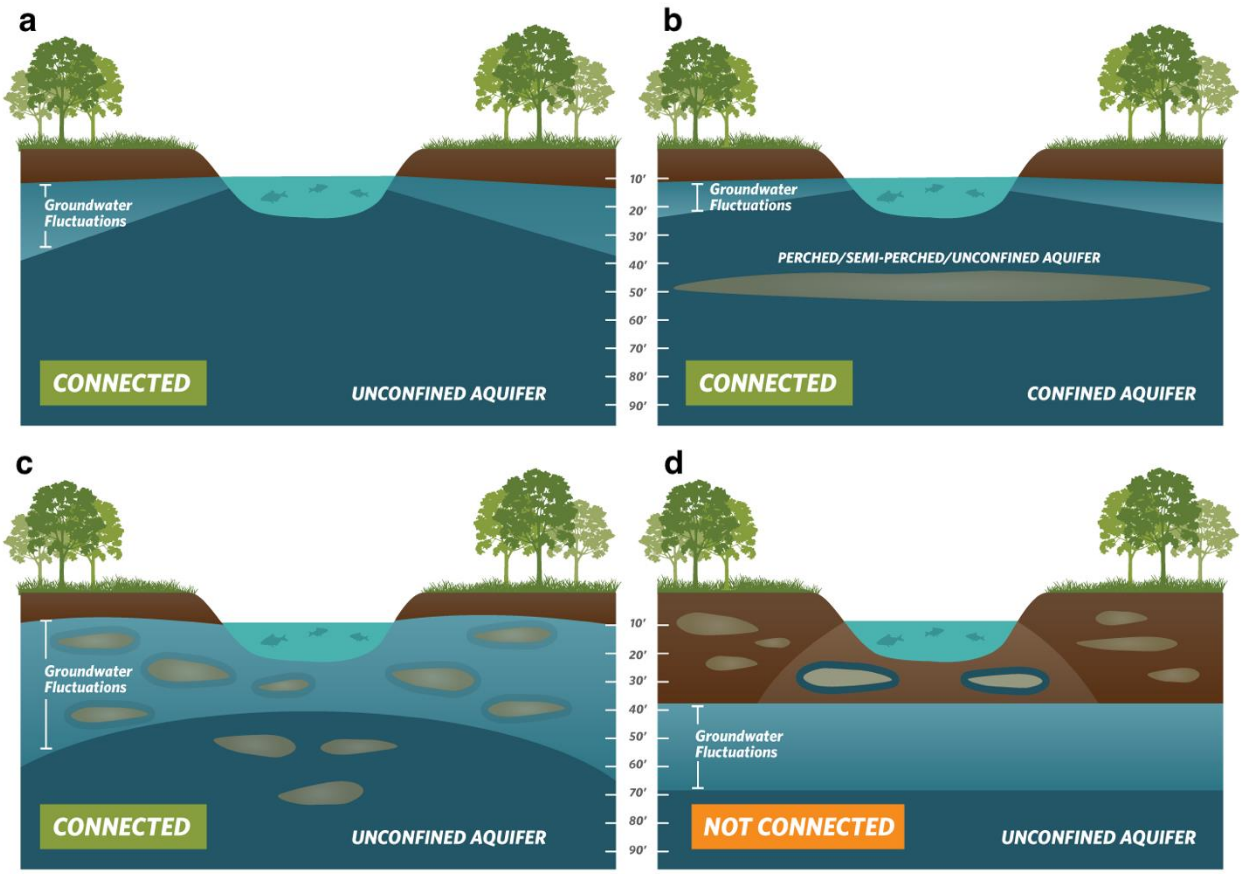

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[12] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[13] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[14] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[15]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network (see Best Practice #6).

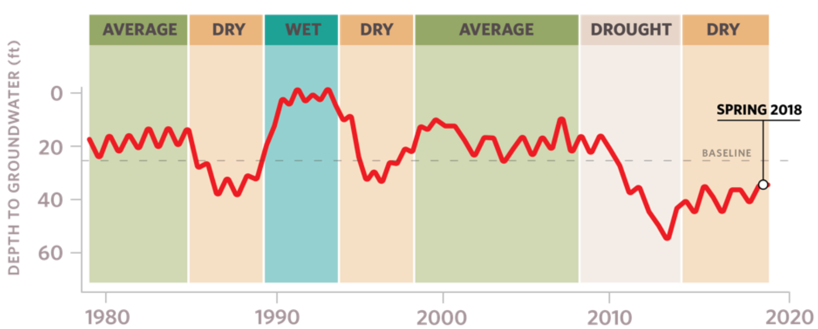

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[12] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[13] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[14] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[15] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[16], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

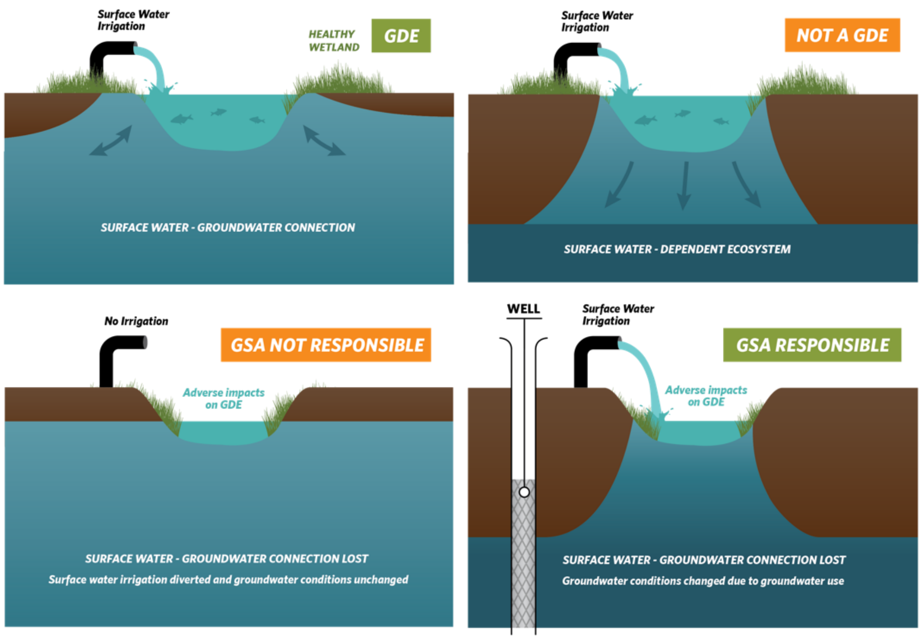


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[16] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

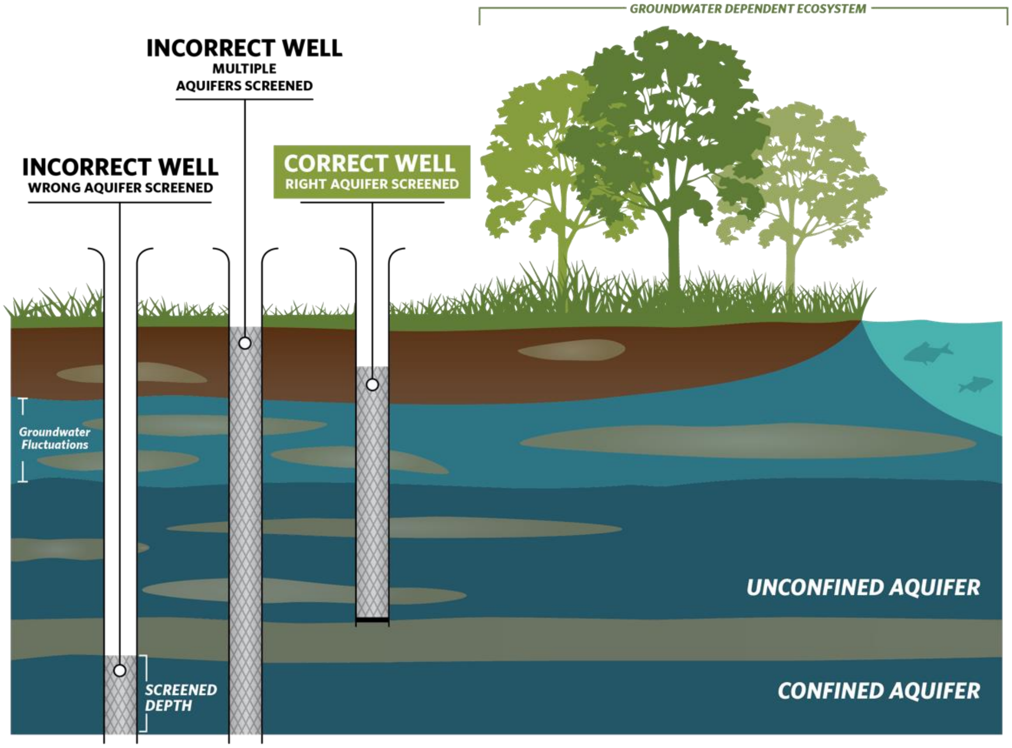


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[17] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

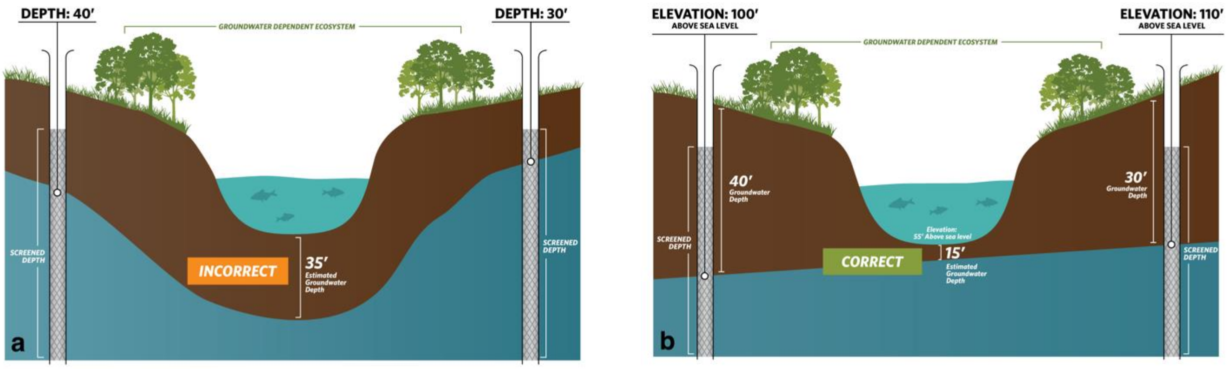


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

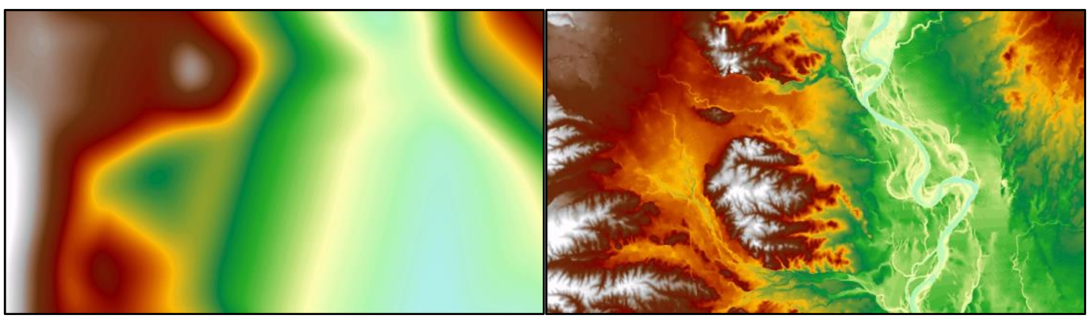


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[17] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

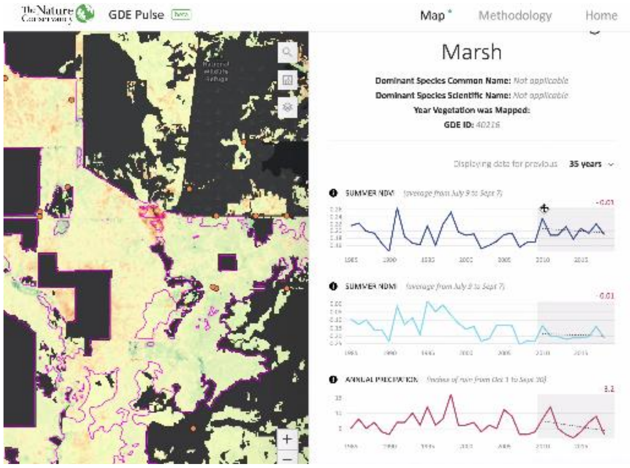
Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

The Nature Conservancy
Protecting nature. Preserving life.

Visit
https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[18]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[19]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[18] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[19] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F

The GSA Response to TNC Comments on the Draft GSP is located on the DWR SGMA portal as Part 2 of 2 of our comments.

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[20]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[21]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[22] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[20] https://www.ncbi.nlm.nih.gov/pubmed/12753220
[21] Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009
[22] Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015

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nature.org
GroundwaterResourceHub.org

June 3, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Kern Groundwater Authority Groundwater Sustainability Plan (GSP)

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Kern Groundwater Authority (KGA) Groundwater Sustainability Agency's (GSA's) Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing *sustainable* groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be insufficient in addressing environmental beneficial uses and users. The identification of environmental beneficial users, as well as their consideration when establishing the sustainability goal, undesirable results, minimum thresholds and measurable objectives were insufficient (23 CCR §355.4(b)(4)) and lacked best available science (23 CCR §355.4(b)(1)). In the face of existing, severe overdraft, the GSP would allow groundwater management to largely ignore potential impacts to environmental beneficial users. This could result in irreparable harm to these beneficial users, undermining the intent of SGMA to achieve sustainability.

Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some case, it may be difficult to address gaps within 180 days. In these cases, we strongly recommend that the Department, at a minimum, set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update. Should the treatment of environmental beneficial users indicate the quality of the overall plan, then we recommend the Department deem the plan inadequate.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides the GSA's response to TNC's comments on the Draft GSP. Attachment G provides a map and method summary of potential ISWs.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We are disappointed to see the feedback that we provided on the draft GSP has been ignored in the final plan, as only 1 out of 37 comments were adequately addressed in the Final GSP. This indicates poor engagement of environmental beneficial users, which undermines the intent of SGMA to ensure that sustainability be defined locally with the participation of all users. Based on our experience the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan" (23 CCR §355.4(b)(10)).

TNC recommendation: We strongly recommend that DWR require the GSA to prioritize stakeholder engagement through improvements to their stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters - The GSP incorrectly excluded potential and/or actual ISWs because the plan did not employ the best available science. The GSP excluded potential ISWs without providing comprehensive monitoring data and quantitative analysis. The data provided in the GSP to substantiate the claims only cover portions of the surface water system. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)).

Map and Assessment of potential ISWs:
By combining multiple years and seasons of groundwater depth data, The Nature Conservancy's assessment found that within portions of Kern Groundwater Authority GSP where sufficient data exist, 16.3 river miles are gaining, 1.7 are losing, and the rest are uncertain, likely disconnected, or have insufficient groundwater depth data to classify connection. Importantly, TNC's analysis excludes large portions of the plan area, where most of the potential ISWs are found, which reinforces the need to assess groundwater-surface water connections in the GSP. Attachment G contains a one-page method summary and a GSP-specific map of ISWs. The interconnected surface water displayed on the map is based on the minimum groundwater depth estimated by the California Department of Water Resources between 2011 and 2018.

Note: In most cases, the groundwater depth data used to generate the ISW map does not include perched aquifers. As such, some streams marked as disconnected could in actuality, be connected.

TNC recommendation: Until a disconnection can be proven, TNC recommends that the GSP include all potential and confirmed ISWs and prioritize the installation of additional shallow wells at locations near high value or sensitive resources that are vulnerable to significant and unreasonable adverse impacts. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 44,294 acres of potential GDEs occur in the GSA boundary. TNC developed the Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

While we were pleased to see that the GSP took some steps to identify and map GDEs, we found that some GDEs were improperly disregarded. We recommend that the GSP remedy the omissions by following our recommendations in Attachment B. The GSP should also revisit all components of the plan where GDEs, as a beneficial user, must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives. Our review found that NC Dataset polygons were improperly removed from the GDE map based on the following:

- GDEs were rejected on the basis that groundwater levels were greater than 30 feet at a single point in time. This is a technically incorrect approach since groundwater levels fluctuate over seasonal and interannual time scales due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Justifying the removal of NC dataset polygons solely based on this criterion does not acknowledge that groundwater levels temporally vary and the fact that many plant species within GDEs can access groundwater depths beyond 30 feet or have adapted water stress strategies to deal with intermittent periods of deep groundwater levels. Using this methodology disregards groundwater fluctuations and can leave many GDEs unprotected in the GSP.

TNC recommendation: TNC recommends that DWR request the GSA to use groundwater levels that represent interannual and inter-seasonal variability and utilize additional information (Attachment D) which provides best practices for using the NC Dataset to identify and consider GDEs throughout the GSP. Specifically, the GSA should use Digital Elevation Model (DEM) when developing depth to groundwater contours, as described in Best Practice #5 in Attachment D.

Water Budget – We were disappointed to see that the water budget did not include the current, historical and projected demands of native vegetation and/or managed wetlands, as required under SGMA (23 CCR §354.18(a) and (b)(3)). The GSP provides a summary of evapotranspiration (ET) for each land cover type but did not provide a breakdown of ET for native and riparian vegetation (such as wetlands, riparian vegetation, phreatophytes and other communities). This is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget nor will they likely be considered in project and management actions.

[1] Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

TNC recommendation: As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

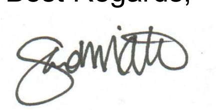
TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

The Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. The GSP does not include the description of a monitoring network to provide methodologies, data and other information to address the data gaps associated with GDEs and ISWs. As a result, the monitoring network does not adequately characterize GDEs and other environmental beneficial users of surface water and groundwater.

TNC recommendation: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but *sustainable* groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,



Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Kern Groundwater Authority Groundwater Sustainability Plan

The complete Kern Groundwater Authority (KGA) Groundwater Sustainability Agency (GSA) Groundwater Sustainability Plan (GSP), adopted on January 15, 2020, was reviewed by TNC. Responses to comments received on the complete public draft GSP are provided as Attachment D of the Final GSP. The TNC comments and responses are also provided in Attachment F of this letter. This attachment lists our original comments on the complete public draft GSP, as submitted during the public comment period, and states whether or not they were addressed in the complete Final GSP *[as green text in brackets]*. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 – Notice & Communication (23 CCR §354.10)

[Section 2.1.5.1 Description of Beneficial Uses and Users in the Basin (p. 38) and Section 2.2.1.4 Kern County Subbasin Boundaries, Criteria for the Extent of Groundwater with Beneficial Use in the Subbasin (p. 60)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* California Water Code §1305(f) defines beneficial uses of waters of the State as including "preservation and enhancement of fish, wildlife, and other aquatic resources and preserves." Section 2.1.5.1 states that beneficial users are stakeholders who have an interest in or need groundwater use. The discussion focuses on active groundwater pumpers but does not mention environmental uses or environmental stakeholders. Section 2.2.1.4 focuses on criteria for determination of groundwater with beneficial use for human consumption or mineral extraction, but omits references in the California Water Code to environmental beneficial uses. **Please describe the other beneficial uses and users of groundwater in the Subbasin identified by the Water Code including: GDEs; managed wetlands; Protected Lands, including preserves, wildlife refuges, conservation areas, recreational areas and other protected lands; and Public Trust Uses, including wildlife, aquatic habitat, fisheries, recreation and navigation.**
- *[Minor changes to GSP text were made but did not adequately address the comment.]* The types and locations of environmental uses, species and habitats supported, and the designated beneficial environmental uses and users of surface waters that may be affected by groundwater extraction in the Subbasin should be specified. **Please identify any environmental uses and users of groundwater in the plan area, and take particular note of the species with protected status.** The following are resources that can be used:
    - Natural Communities Commonly Associated with Groundwater dataset (NC Dataset) - https://gis.water.ca.gov/app/NCDatasetViewer/;

- A list of freshwater species located in the Kern County Subbasin in Attachment C of this letter; and
- The California Department of Fish and Wildlife's California Natural Diversity Database (CNDDB).

Checklist Items 2 to 4 - Description of Plan Area (23 CCR §354.8)

[Section 2.1.2 Plan Area Setting (pp. 13-14)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* The GSP provides a description of the groundwater well types and well density; however, there is no discussion of instream flow requirements, if any, or how the water infrastructure is in compliance with regulatory requirements to protect species of concern in the surface waters within the Subbasin. **Please provide a description of any current and planned instream flow requirements or regulatory requirements for protection of species of concern in the Kern River, Poso Creek and Caliente Creek. If there are no requirements in place or planned, then please state that in the GSP.** Furthermore, while the response claims that Kern River is not within KGA, Figure 1-1 clearly shows that sections of the Kern River are within the boundary of KGA.

[Section 2.1.3 Existing Plans in the Plan Area (pp. 17-18)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* This section summarizes the Kern County General Plan and general plans for cities within the GSP area. The plan descriptions are focused on goals and policies directly related to groundwater resources and do not include policies and goals related to surface water resources that may be connected to groundwater. **We suggest adding a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals. Please include a description of any land use or environmental plans relevant to wetlands, aquatic resources and other GDEs and ISWs and their relationship to the GSP. Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands around the Kern Wildlife Refuge, aquatic resources and other GDEs and ISWs.**
- *[Minor changes to GSP text were made but did not adequately address the comment.]* This section is focused on discussion of agriculture and irrigation needs, demands, and types of irrigation, and the groundwater resources policies and goals in general plans. It does not include any other applicable land use or environmental plans that may contain information relevant to the GSP and ISWs. This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin and if they are associated with critical, GDE or ISW habitats. **Please identify all relevant HCPs and NCCPs within the Subbasin and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.**

[Section 2.1.4 Existing and Ongoing Water Resource Programs (pp. 29-31)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater *and related surface conditions* (emphasis added). In order for this section to provide the appropriate context and help assure integration of GSP implementation with other ongoing regulatory programs, additional information on water use management and monitoring programs relevant to wetlands, sensitive or critical habitat, and GDEs and their relationship to the GSP should be provided.
  - **Please provide a description of resource management plans, monitoring activities and responsibilities by State, Federal and local agencies and jurisdictions related to aquatic resources and GDEs that could be affected by groundwater withdrawals, and list them in Table 2-1.**
  - The Critical Habitat for Threatened and Endangered Species website maintained by US Fish and Wildlife Service (https://fws.maps.arcgis.com/home/webmap/viewer.html?webmap=9d8de5e265ad4fe09893cf75b8dbfb77) identifies multiple lands with endangered and threatened species in the Subbasin, for instance, Buena Vista Lake Ornate Shrew (*Sorex ornatus relictus*) occurs within the area. **Please review and discuss the potential groundwater reliance of critical species in the Subbasin. Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.**
  - Other GDEs and sensitive habitats. **Please include a discussion of any monitoring programs related to GDEs and sensitive habitats.**

[Section 2.1.4.3 Well Permitting Process (p. 34) and Section 2.1.4.4 Plan Elements from CWC Section 10727.4 (g) Well Construction Policies (p. 34-37)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* These sections discuss the Kern County Public Health Services Department Water Well Program, which issues permits to construct, reconstruct, and destroy water wells. The discussion does not provide any details regarding the potential effects of the permitting and construction of new wells on aquifer systems, GDEs and ISWs.
  - **Please discuss that future well permitting and well construction must be coordinated with the GSP to assure achievement of the Plan's sustainability goals.**
  - **Please state how the well permitting process incorporates protection of GDEs and ISWs within the Subbasin.**
  - The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF v. SWRCB and Siskiyou County, No. C083239). **Please**

include a discussion of the need for well permitting programs to comply with this requirement.

Checklist Items 5 to 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 2.2.1.5 Bottom of Subbasin (p. 60)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* The bottom boundary of the Subbasin should be more precisely defined in accordance with DWR guidance. As noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions." Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom. This will prevent the possibility of extractors with wells deeper than the basin boundary (defined by the base of freshwater) from claiming exemption of SGMA due to their well residing outside the vertical extent of the basin boundary. **Please characterize groundwater well extractions from the deepest wells in relation to defining the basin bottom**. If the bottom boundary of the Subbasin has not been clearly defined in certain management areas, **please identify this as a data gap and elaborate in the monitoring section how and where additional observations can be made to reconcile this data gap.**

[Section 2.2.1.6 Principal Aquifers and Aquitards (pp. 80-74)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* The GSP includes a relatively robust description of the geologically diverse aquifers in the Subbasin with differing zones of confined, semiconfined and unconfined groundwater conditions, in addition to "shallow zones" stated to be present locally in the northwestern and southern portions of the central Subbasin. The GSP states these are *"not a part of active groundwater extraction, but data are included in the groundwater conditions section of this report to evaluate changes over time."* On page 53, environmental users are identified as beneficial groundwater users of the primary aquifers in the Subbasin. Please note that a Principal Aquifer is defined in the GSP regulations as including *"aquifers or aquifer systems that store, transmit, and yield significant … quantities of groundwater to … springs, or surface water systems*" (23 CCR §351(aa). As such, if the shallow aquifer interacts with surface water systems or provides groundwater necessary to sustain GDEs or other environmental beneficial users, it should be considered a Principal Aquifer. No description, data or information is provided regarding the potential effect of groundwater extraction from groundwater production aquifers on the uppermost shallow aquifers and groundwater bearing zones, whether perched aquifers exist, and how the shallow aquifers or zones are connected to and interact with surface water and GDEs. **Please provide additional description of the shallow aquifers within the Subbasin including characteristics of interconnections with surface water and GDEs, vertical groundwater**

gradients, connections with underlying production aquifers, and the resulting potential interaction of groundwater pumping with ISWs and GDEs. Please state whether localized perched aquifers are present in the Subbasin. Describe any data gaps. The function and significance of the Shallow Aquifers that provide groundwater to ISWs and GDEs should be summarized in Table 2-3.

- *[Minor changes to GSP text were made but did not adequately address the comment.]* **Please describe whether the existence of Aquifer Exemptions has any bearing or implications related to environmental beneficial uses of groundwater.**

[Section 2.2.1.7 Data Gaps and Uncertainty (p. 74)]

- *[Our comment was not adequately addressed by KGA's response. No changes to GSP text made.]* **If data are not present to produce the information requested in the comment above, please clearly identify this as a data gap. Please elaborate in the monitoring section how and where additional observations are to be conducted in order to address this data gap.**

[Section 2.2.1.8 Cross Sections (pp. 74-84)]

- *[Our comment was not addressed. No changes to GSP text made.]* Regional basin-wide geologic cross sections are provided in Figures 2-19a through 2-19g. These cross-sections do not include a graphical representation of the manner in which the very shallow groundwater or perched water may interact with ISWs or GDEs that would allow the reader to understand this topic. **Please include near-surface cross sections or insets that depict the conceptual understanding of shallow groundwater and ISW interactions at different locations, including perched and regional aquifers and GDEs.**

[Section 2.3.1.1 Elevation and Flow Directions (pp. 98-105)]

- *[Our comment has been adequately addressed through GSP text changes. Thank you for identifying the data gap.]* This section states that the depth to groundwater in the Shallow Zone ranges from 5 to 25 feet. Inference is made that groundwater levels in the Shallow Zone is relatively constant and is typically perched on fine grained sedimentary units and likely disconnected from the productive aquifer system. No specific data or hydrogeologic analysis is provided to substantiate these important claims. **Please provide any available stratigraphic data, hydrograph data, pumping test data or other information to substantiate these claims. If the data are not available, please identify this as a data gap.**

<u>Checklist Items 8, 9 and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)</u>

[Section 2.3.5 Interconnected Surface Water Systems (pp. 134-142)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted." "At any point" has both a spatial and temporal component. Even short durations of interconnection between groundwater and surface water can be crucial for surface water flow and support of environmental users and uses of groundwater and surface water. ISWs can be either gaining or losing. The text states (p. 134) that *"Within the Subbasin, there are no interconnected natural surface water systems in monitored areas associated with the pumping zone of the regional aquifer system"* and *"Since the advent of groundwater pumping in the Subbasin and subsequent impoundment and regulation of flow of the Kern River, groundwater levels near the river are no longer connected with the river bed by a continuous saturated zone."* However, the data provided to substantiate these broad claims cover only portions of the surface water flow system. The models cited as substantiation were not constructed for the purpose of identifying potential ISWs and GDEs, but are regional models constructed for supply management. In fact, the text also states (p. 142) that the Kern River has gained flow during some years and the upper reach of the Kern River in the Subbasin has been identified as gaining. The connection between surface water and groundwater is mentioned as a data gap in Section 2.3.7.4 (p. 142). Furthermore, the depth to water in the shallow aquifer is quite shallow as discussed above (5 to 20 feet below ground surface), which strongly suggests that interaction between the shallow aquifer and surface water may be occurring. Because there are uncertainties in the hydraulic connection between rivers / streams and shallow groundwater, ISWs should not be disregarded in the GSP. The GSP regulations require reliance on the best available information and clear identification of data gaps when sufficient information is not available. **Please provide additional data or analysis to substantiate the nature of the hydrologic relationship between the shallow aquifer and production aquifers and ISWs. If data are not available to verify that such a connection does not exist, acknowledge where ISWs may exist and identify appropriate sustainable management criteria, monitoring networks and management actions for sustainable ISW management or to address data gaps. Data could include groundwater level data from shallow or nested monitoring wells, comparison of stream stages to groundwater levels, modeling information or additional gaging data. Please elaborate how and where additional observations (shallow monitoring wells, stream gauges, and nested / clustered wells) along surface water features can be used to address data gaps in the Monitoring Network section of the GSP to improve identification of ISWs rather than prematurely disregarding them in the GSP**. Furthermore, while KGA's response to our comments claims that Kern River is not within the jurisdiction of KGA, Figure 2-1 in KGA GSP and Figure 2-2 in KRGSA GSP clearly shows that sections of Kern River are within the jurisdictional area of KGA.

<u>Checklist Items 11 to 15 – Identifying and Mapping GDEs (23 CCR §354.16)</u>

[Section 2.3.6 Groundwater-Dependent Ecosystems (pp. 151-152)]

- *[No response is required for this comment.]* We applaud KGA for using the NCCAG database, developed through a collaboration between DWR, California Department of Fish and Wildlife (CDFW) and TNC, to identify potential GDEs, and then evaluate the NCCAG results to identify GDEs; however, the approach used is based on narrative analysis and quantitative data are not used. In addition, no determination is presented as to which NCCAG polygons represent GDEs. **Please refer to Attachment D of this letter for best practices in using groundwater data to verify whether NCCAGs are GDEs.**
- *[Our comment was not adequately addressed through the response. No changes to GSP text made.]* The text states (p. 152): "*Groundwater potentiometric surfaces from Kern Fan Monitoring Reports (KCWA, 2016) indicate that underlying aquifers are not connected with stream channels. Some flow in the Kern River, as well as in Poso Creek and other mountain-front creeks, is likely to be sustained periodically by release of bank storage (surface water stored in stream banks), but the underlying groundwater is too deep to sustain flow in the valley floor.*" This contradicts the statements on page 142 that the Kern River has gained flow during some years and the upper reach of the Kern River in the Subbasin are identified as gaining. If there are insufficient groundwater level data in the upper aquifer where gaining reaches are located or where bank storage is inferred to occur, then the NCCAGs in these areas should be included as GDEs in the GSP until data gaps are reconciled in the monitoring network. **Please identify any data gaps related to identifying and mapping GDEs. If there are data gaps, please describe in detail in the monitoring plan how the data gaps will be addressed.**
- *[Our comment was not adequately addressed through the response. No changes to GSP text made.]* The text states (p. 152): "*The conditions in the center of the Subbasin suggest that the groundwater production aquifer does not reach the shallow subsurface. The production aquifer lies at depths that prevent surface water expressions or accessibility for vegetation.*" **Please support this statement with specific groundwater level data that indicate a gap in the saturated zone between the production aquifers and shallow groundwater, and define the extent of the NCCAG dataset polygons that are excluded from consideration as GDEs on this basis.**
- *[Our comment was not adequately addressed through the response. No changes to GSP text made.]* The text states (p. 152): "Based on the NCCAG dataset along the margins of the Subbasin where spring-fed streams exist, further confirmation is needed to evaluate the presence of GDEs." If there are insufficient groundwater level data in the upper aquifer where these stream-fed springs exist, then the NCCAGs in these areas should be included as GDEs in the GSP until data gaps are reconciled in the monitoring network. **Please identify any data gaps related to identifying and mapping GDEs. If there are data gaps, please describe in detail in the monitoring plan how the data gap will be resolved.**
- *[Our comment was not adequately addressed through the response. No changes to GSP text made.]* Because data gaps have been identified in Section 2.2.1.7 (p. 74) Section 2.3.7.4 (p. 142) and Section 2.3.8.2 (p. 152) related to shallow groundwater conditions and the identification of ISWs and GDEs within the Subbasin, final determination of the extent of GDEs in the Subbasin has yet to be completed.

Please revise the GDE analysis in the GSP by conducting more substantial, data-based evaluation focusing on GDE identification in the GSP, clearly identify which NCCAG polygons are excluded, which polygons are determined to be GDEs and which polygons are uncertain at this time and will be verified as data gaps are address. SGMA defines GDEs as "ecological communities and species that depend on *groundwater emerging from aquifers or on groundwater occurring near the ground surface*" (emphasis added). **Confirmation of GDEs should be performed based on depth to groundwater in the shallow zone, and additional information provided as to whether the shallow zone may be affected by groundwater withdrawal from the production aquifers. Please refer to Appendix D of this letter for best practices for using groundwater data to verify a connection to groundwater.**

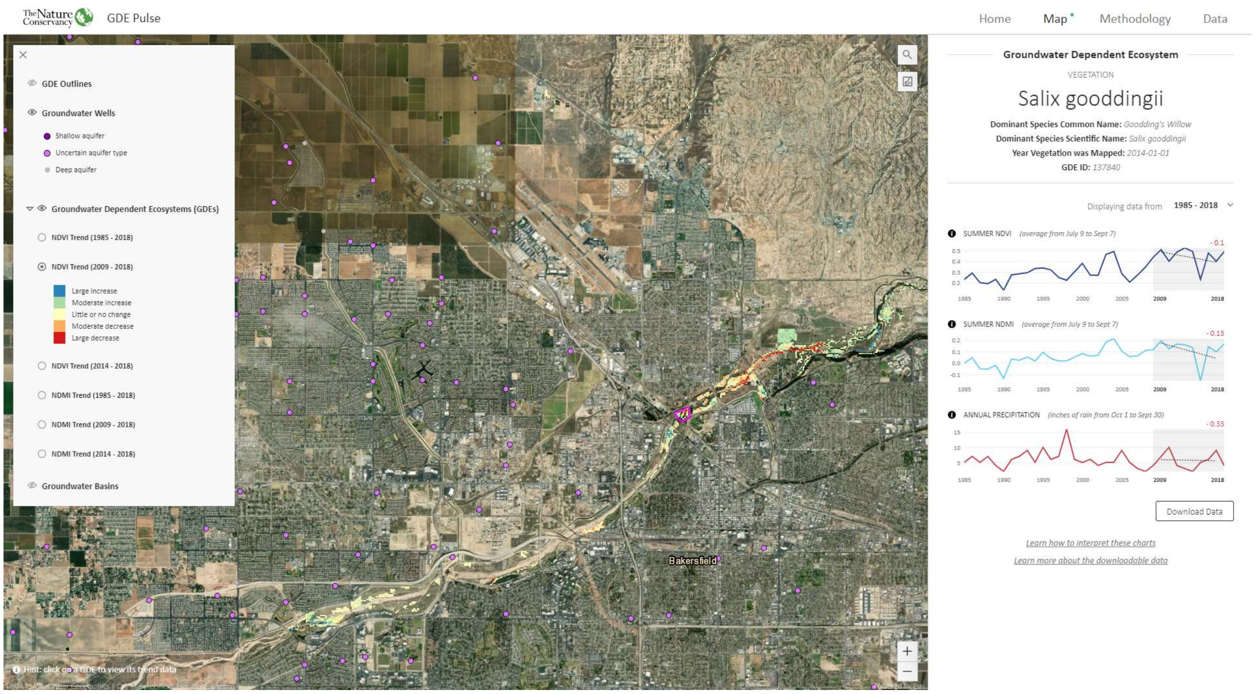
- *[Our comment was not adequately addressed through the response. No changes to GSP text made.]* In the scientific literature, it is generally acknowledged that GDEs can rely on groundwater for *some or all* of their requirements (emphasis added). GDEs can rely on multiple water sources simultaneously and at different temporal and/or spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow). SGMA defines GDEs as "ecological communities and species that depend on groundwater *emerging from aquifers* or on groundwater *occurring near* the ground surface" (emphasis added). **Therefore, we recommend using depth to groundwater contour maps derived from subtracting groundwater levels from a DEM, as described above, to identify whether a potential connection to groundwater exists for the wetlands mapped in Attachment H of the GSP. Please refer to Attachments D and E of this letter for best practices for using local groundwater data to 1) verify whether polygons in the NC Dataset are supported by groundwater in an aquifer, and 2) verify whether ecosystem decline or recovery is correlated with groundwater levels.**

Checklist Items 16 to 20 – Describing GDEs (23 CCR §354.16)

[Section 2.3.6 Groundwater-Dependent Ecosystems (pp. 151-152)]

- *[Our comment was not adequately addressed through the response. No changes to GSP text made.]* Very little description is provided regarding the nature and function of identified GDEs in the west-central and south-central portions of the Subbasin, their potential sensitivity to groundwater and surface water supply changes, or their relative habitat value. **We recommend the inclusion of a discussion regarding the nature and characteristics of GDEs.**
- *[Our comment was not adequately addressed through the response. No changes to GSP text made.]* **Please provide information on the historical or current groundwater conditions near the GDEs or the ecological conditions present.** Refer to GDE Pulse (https://gde.codefornature.org or Attachment E of this document) or other locally available data (e.g. leaf area index, evapotranspiration or other data developed from remote sensing) and depth to groundwater trends in and

around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC Dataset polygons found in the Subbasin.



- *[Our comment was not adequately addressed through the response. No changes to GSP text made.]* **We recommend an ecological inventory (see Appendix III, Worksheet 2 of the GDE Guidance) for all potential GDEs that includes vegetation or habitat types and rank the GDEs as having a high, moderate or low value. Explain how each rank was characterized.**
- *[Our comment was not adequately addressed through the response. No changes to GSP text made.]* **Please identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat were found in or near any of the GDEs. Some organisms rely on uplands and wetlands during different stages of their lifecycle**. Resources for this include the list of freshwater species located in the Subbasin that can be found in Attachment C of this letter, the Critical Species Lookbook, and CDFW's CNDDB database.

Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)

[Section 2.4 Water Budget (p. 152)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* The GSP provides summary and refers to Attachment H for water budget information. In Attachment H, Section 3.7.1 discusses the development of evapotranspiration (ET) rates for each land cover type (p. 11). **Please provide a breakdown of ET for native and riparian vegetation (such as wetlands,**

riparian vegetation, phreatophytes and other communities). Please evaluate the spatial relationship of native vegetation ET to NCCAG polygons to determine the groundwater use by this beneficial user for inclusion in the water budget. Identify any data gaps and outline the actions needed to address them.

Checklist Items 23 to 25 – Sustainability Goal (23 CCR §354.24)

[Section 3.1 Sustainability Goal (p. 175)]

- *[Our comment was not adequately addressed through the response. No changes to GSP text made.]* The sustainability goal of the Kern County Subbasin is to *"Achieve sustainable groundwater management…Maintain its groundwater use within the sustainable yield of the basin…Operate within the established sustainable management criteria...maintain sustainability over the implementation and planning horizon."* The GSP regulations (23 CCR §354.24) require that *"[t]he Plan shall include a description of the sustainability goal, … a discussion of the measures that will be implemented to ensure that the basin will be operated within its sustainable yield, and an explanation of how the sustainability goal is likely to be achieved … and maintained … ."* The stated sustainability goal recites regulatory requirements and does not provide a description of the goal relative to the basin setting and beneficial uses. The goal does not mention environmental uses and users of groundwater and does not mention undesirable results. **Please clarify the sustainability goal and expand its description to ensure that all beneficial uses and users of groundwater are identified as being protected from undesirable results, and in particular, include GDEs, ISWs and related critical habitats**.
- *[Our comment was not adequately addressed through the response. No changes to GSP text made.]* **Since GDEs and ISWs may be present in the Subbasin (please see comments under Checklist Items 16-20) they should be recognized as beneficial users of groundwater and should be specifically included in the Sustainability Goal. In addition, a statement about any intention to address pre-SGMA impacts should be included.**
- *[Our comment was not adequately addressed through the response. No changes to GSP text made.]* The GSP states that there is no ISW connectivity for the Kern River; however, there isn't any data, analysis and / or other information provided to support this broad conclusion. **Please include ISWs in the Sustainability Goal until/unless sufficient data is available and provided to verify the status of ISWs.**
- *[Our comment was not adequately addressed through the response. No changes to GSP text made.]* GDEs are dependent, in part, on suitable water quality; however, the GSP only considers water quality for irrigation and domestic use. **Given that there are potential GDEs in the Subbasin and that they may be affected by water quality, they should be included in the Sustainability Goal and addressed in the Water Quality section.**

Checklist Item 26 – Measurable Objectives (23 CCR §354.30) and Checklist Items 27 to 29 - Minimum Thresholds (23 CCR §354.28)

[Section 3.3 Minimum Thresholds and Measurable Objectives (pp. 181-195)]

- *[Our comment was not adequately addressed through the response. Minor changes to GSP text made.]* Minimum thresholds and measurable objectives for chronic lowering of groundwater levels, reduction of groundwater storage and degraded water quality do not include environmental beneficial users, such as ISWs or GDEs. **For each of these applicable sustainable management criteria, please include a discussion of GDEs (see comments under checklist items 16-20) and whether the minimum thresholds, measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment. Please modify Section 3.2.2 to specifically address impacts from degraded water quality to the plant and wildlife communities within GDEs.**

<u>Checklist Items 30 to 46 – Undesirable Results (23 CCR §354.26)</u>

[Section 3.2.2.2 Potential Effects of Chronic Lowering of Groundwater Levels (p. 177)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* GDEs are a beneficial user of groundwater in the Subbasin. **Unless evidence is provided to verify the exclusion of GDEs please modify this section of the GSP to identify GDEs as one of the beneficial uses and users of groundwater that could experience significant and unreasonable effects as a result of chronic lowering of groundwater levels.**

[Section 3.2.7 (Undesirable Results for depletion of) Interconnected Surface Water (p. 181)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* The GSP states (p.195) that *"Though many studies have been conducted in the Subbasin, including in areas such as the Kern River and Poso Creek, results do not show evidence of surface water within the Subbasin to be interconnected. As there are no known natural interconnected surface water systems within the KGA boundary, this sustainability indicator is not included in this GSP."* As noted in the prior comments, several areas have been identified as potential ISWs and GDEs, and substantial data gaps exist. As such, the above statement contradicts other information provided in the GSP, and serves as an acknowledgement of data gaps. It is not an appropriate basis for removing this sustainability indicator from the GSP under the GSP regulations. **Unless evidence is provided to verify the exclusion of GDEs and ISWs, please modify this section of the GSP to include a statement that 1) there are potential ISWs, and 2) provide an assessment of potential undesirable results.**
- *[Minor changes to GSP text were made but did not adequately address the comment.]* The GSP states (p.144) that *"… there is no interconnected surface water under the influence of groundwater pumping in the principal aquifer in this area and no impacts to interconnected surface water have been observed."* As noted in the prior comments, areas of shallow groundwater and gaining stream reaches are known to exist in the Subbasin. No quantitative data have been provided to assess

the extent of hydraulic connection between shallow groundwater and the underlying production aquifers. As such, the above statement is insufficiently supported by data and is actually a substantial data gap. **Unless evidence is provided to verify the potential influence of groundwater extraction on GDEs and ISWs, please modify this section of the GSP to include a statement that the data are insufficient to assess whether GDEs can experience significant and unreasonable effects as a result of groundwater extraction in the Subbasin and provide an assessment of potential undesirable results. Please also identify that existing data gaps will be addressed and the presence or absence of GDEs will be verified with monitoring wells screened at the appropriate depths.**

[Section 3.2 Undesirable Results (for each sustainability indicator) (pp. 175-181)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* This section only describes undesirable results relating to human beneficial uses of groundwater and neglects environmental beneficial uses / users that could be adversely affected by chronic groundwater level decline or other undesirable results. **Please add "possible adverse impacts to potential GDEs and ISWs" to the list of potential undesirable results.**
- *[Minor changes to GSP text were made but did not adequately address the comment.]* The GDE Pulse web application developed by TNC provides easy access to 35 years of satellite data to view trends of vegetation metrics, groundwater depth (where available), and precipitation data. This satellite imagery can be used to observe trends for NC Dataset polygons within the Subbasin. Over the past 10 years (2009-2018), some NC Dataset vegetation polygons have experienced adverse impacts to vegetation growth and moisture in the western portion of the Subbasin. **Please review these spatial patterns and, where possible, correlate them with water level trends. Any indications of adverse trends and any data gaps should be identified.**

  - **For each identifiable GDE unit with supporting hydrological datasets, please include the following:**
    - Plot and provide hydrological datasets;
    - Define the baseline period in the hydrologic data;
    - Classify GDE units as having high, moderate, or low susceptibility to changes in groundwater; and
    - Explore cause-and-effect relationships between groundwater changes and GDEs.
  - **For identifiable GDE units without supporting hydrological datasets please describe data gaps and / or insufficiencies.**
  - **Compile and synthesize biological data for each GDE unit by:**
    - Describing biological resources for each GDE unit; and
    - Describing data gaps / insufficiencies.
  - **Describe possible effects on potential ISWs, GDEs, land uses, and property interests, including:**

  - Cause-and-effect relationships between potential ISWs and GDEs with groundwater conditions;
  - Impacts to potential ISWs and GDEs that are considered to be "significant and unreasonable;"
  - Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities;
  - Land uses should include recreational uses (e.g., fishing/hunting, hiking, boating); and
  - Property interests should include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.

<u>Checklist Items 47-49 – Monitoring Network (23 CCR §354.34)</u>

[Section 3.4 Monitoring Network (pp. 195-216)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* The GSP proposes to coordinate and use existing monitoring networks of Kern Groundwater Authority and its districts / member agencies for groundwater elevations and storage, groundwater quality, and land subsidence. The text (p. 197) states that the monitoring network will monitor impacts to the beneficial uses and users of groundwater and goes on to state that "*<u>depletions of interconnected surface water are not pertinent to the monitoring network</u>*."(emphasis added) As discussed in previous comments, unless data are provided to support this broad statement, due to uncertainties in the hydraulic connection between rivers / streams and GDEs with shallow groundwater, ISWs and related GDEs should not be disregarded in the GSP. The GSP should include a description of how groundwater conditions will be monitored to assess the potential effects of groundwater withdrawals on ISWs and GDEs. In addition, this section should include a description of how hydrological data gaps and insufficiencies will be addressed in the monitoring network. **Please modify the description of the monitoring network to provide methodologies, data and other information to address the data gaps associated with GDEs and ISWs. This modification should include 1) locating new wells that are appropriately screened to detect changes in groundwater levels in the uppermost water table and the connectivity of GDEs and ISWs with the upper unconfined or shallow zone aquifer; and 2) identifying or installing additional stream gauges in areas where there is potential for ISWs and GDEs. Please expand on the discussion of how the new well and stream data will be used to improve ISW mapping and inform an adequate analysis, and how the data will be used to verify possible GDEs.**
- *[Minor changes to GSP text were made but did not adequately address the comment.]* As stated above in the comments for Checklist Items 8-10, **please address data gaps along the Kern River and tributary creeks identified earlier in the GSP in this section of the GSP to improve ISW mapping in companion or future GSPs (e.g., through shallow monitoring wells, stream gauges, and nested/clustered wells)**.

Checklist Items 50 and 51 – Projects and Management Actions (23 CCR §354.44)

[Section 4 Projects and Management Actions (p. 217)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* Table 4-1 in this chapter lists many important projects and management actions including allocation changes, imports, surface water diversions, pumping allowances, conveyance and recharge projects, and addition of percolation basins; however, the descriptions only identify benefits to water level, groundwater storage, water quality and water supply. Maintenance or recovery of groundwater levels and construction of recharge facilities may have potential environmental benefits. It would be advantageous to recognize these benefits so as to demonstrate multiple benefits from a funding and prioritization perspective.
    - **For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue**.
    - If ISWs and GDEs will not be adequately protected by the listed projects and management actions, **please consider additional management actions and projects targeted for protecting ISWs and GDEs.**
    - **Please describe how the projects and management actions will be evaluated to assess whether adverse impacts to GDEs may occur and/or will be mitigated or prevented.**
    - For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

Attachment C

Freshwater Species Located in the Kern County Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Kern County Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[2]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[3] as well as on TNC's science website[4].

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			

[2] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[3] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[4] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Dendrocygna bicolor	Fulvous Whistling-Duck		Special Concern	BSSC - First priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Lithobates pipiens	Northern Leopard Frog		Special Concern	ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS AND OTHERS				
Anax junius	Common Green Darner			
Argia emma	Emma's Dancer			
Argia lugens	Sooty Dancer			
Argia vivida	Vivid Dancer			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Enallagma cyathigerum				Not on any status lists
Erythemis collocata	Western Pondhawk			
Hetaerina americana	American Rubyspot			
Ischnura cervula	Pacific Forktail			
Libellula comanche	Comanche Skimmer			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Libellula forensis	Eight-spotted Skimmer			
Libellula saturata	Flame Skimmer			
Pachydiplax longipennis	Blue Dasher			
Paltothemis lineatipes	Red Rock Skimmer			
Pantala flavescens	Wandering Glider			
Pantala hymenaea	Spot-winged Glider			
Rhionaeschna multicolor	Blue-eyed Darner			
Sympetrum corruptum	Variegated Meadowhawk			
Tramea lacerata	Black Saddlebags			
Tramea onusta	Red Saddlebags			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Margaritifera falcata	Western Pearlshell		Special	
Physella virginea	Sunset Physa			Currently Stable
Planorbella traski	Keeled Rams-horn			X
PLANTS				
Alnus rhombifolia	White Alder			
Ammannia coccinea	Scarlet Ammannia			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla filiculoides	NA			
Baccharis glutinosa	NA			Not on any status lists
Baccharis salicina				Not on any status lists
Bacopa eisenii	Gila River Water-hyssop			
Berula erecta	Wild Parsnip			
Bidens laevis	Smooth Bur-marigold			
Bolboschoenus maritimus paludosus	NA			Not on any status lists

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Carex pellita	Woolly Sedge			
Castilleja minor minor	Alkali Indian-paintbrush			
Cephalanthus occidentalis	Common Buttonbush			
Chloropyron molle hispidum			Special	CRPR - 1B.1
Cicuta douglasii	Western Water-hemlock			
Cirsium crassicaule	Slough Thistle		Special	CRPR - 1B.1
Cotula coronopifolia	NA			
Cyperus erythrorhizos	Red-root Flatsedge			
Echinodorus berteroi	Upright Burhead			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis palustris	Creeping Spikerush			
Eleocharis parishii	Parish's Spikerush			
Eleocharis rostellata	Beaked Spikerush			
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Juncus textilis	Basket Rush			
Lasthenia ferrisiae	Ferris' Goldfields		Special	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Lasthenia glabrata coulteri	Coulter's Goldfields		Special	CRPR - 1B.1
Lemna gibba	Inflated Duckweed			
Lemna minor	Lesser Duckweed			
Lepidium oxycarpum	Sharp-pod Pepper-grass			
Ludwigia peploides peploides	NA			Not on any status lists
Lupinus polyphyllus burkei				Not on any status lists
Lycopus americanus	American Bugleweed			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Lythrum californicum	California Loosestrife			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus guttatus	Common Large Monkeyflower			
Myosurus minimus	NA			
Paspalum distichum	Joint Paspalum			
Perideridia pringlei	Pringle's Yampah		Special	CRPR - 4.3
Persicaria lapathifolia				Not on any status lists
Persicaria pensylvanica	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phacelia distans	NA			
Phalaris arundinacea	Reed Canarygrass			
Phyla nodiflora	Common Frog-fruit			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pluchea odorata odorata	Scented Conyza			
Pluchea sericea	Arrow-weed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus tenellus	NA			
Puccinellia simplex	Little Alkali Grass			
Rhododendron occidentale occidentale	Western Azalea			
Rorippa palustris palustris	Bog Yellowcress			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Rumex conglomeratus	NA			
Rumex salicifolius salicifolius	Willow Dock			
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus americanus	Three-square Bulrush			
Sesbania herbacea				Not on any status lists
Stachys albens	White-stem Hedge-nettle			
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	NA			
Zannichellia palustris	Horned Pondweed			
FISHES				
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Lampetra hubbsi	Kern brook lamprey		Special Concern	Vulnerable - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		Special	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		Special Concern	Near-Threatened - Moyle 2013
Mylopharodon conocephalus	Hardhead		Special Concern	Near-Threatened - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
Notes: ARSSC = At-Risk Species of Special Concern				

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
BCC = Bird of Conservation Concern BSSC = Bird Species of Special Concern CRPR = California Rare Plant Rank IUCN = International Union for Conservation of Nature SSC = Species of Special Concern				

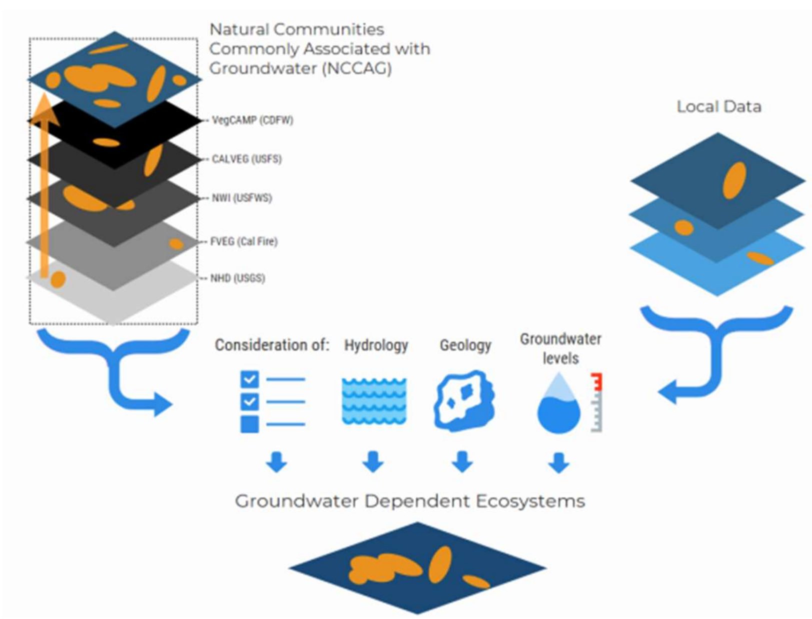
Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[5] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[6]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[5] *NC Dataset Online Viewer:* https://gis.water.ca.gov/app/NCDatasetViewer/

[6] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[7]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[8] on the Groundwater Resource Hub[9], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[7] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[8] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[9] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

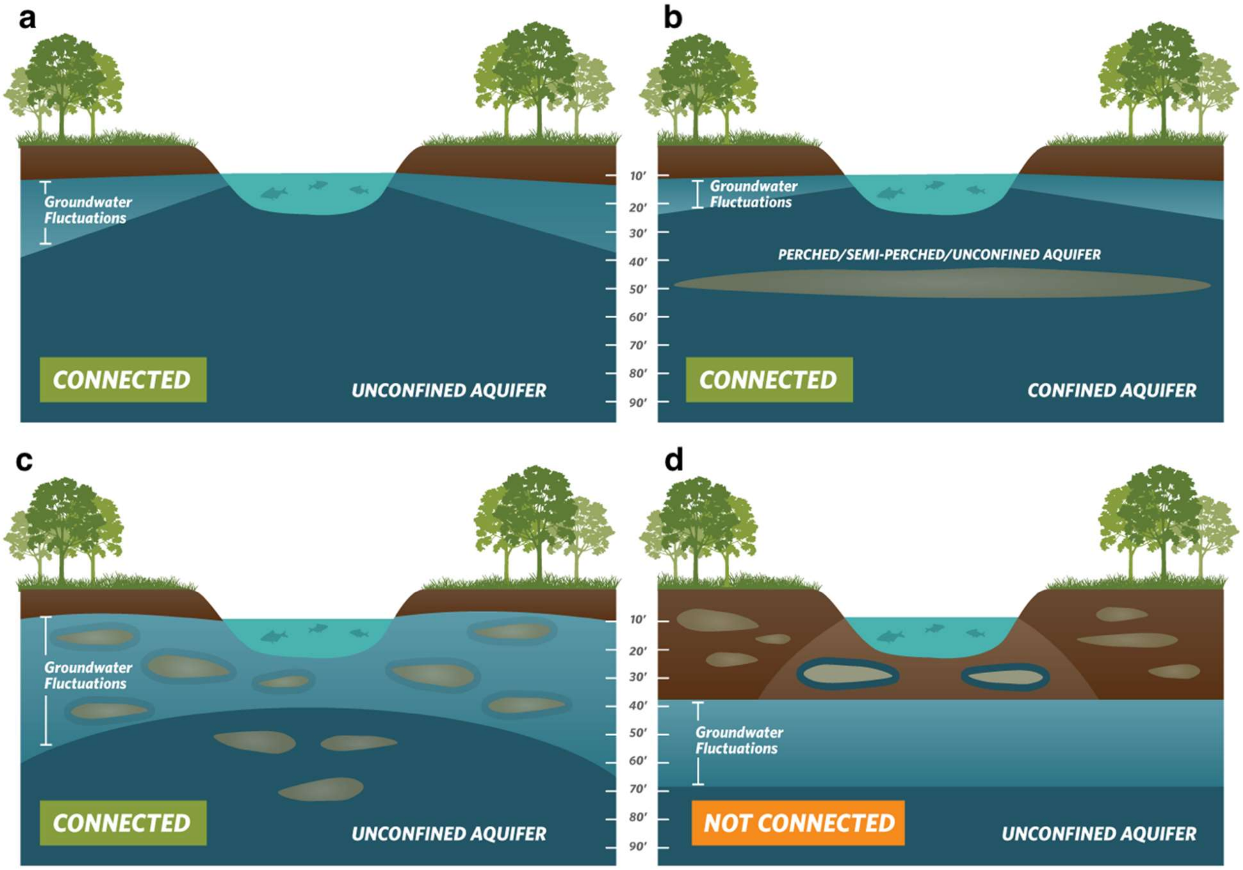

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[10] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[11] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[12] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[13]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network (see Best Practice #6).

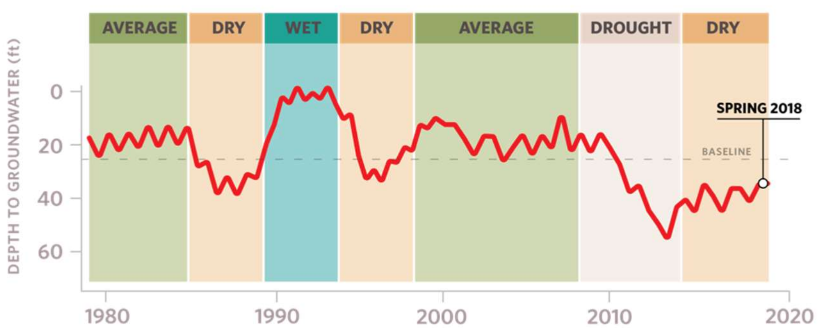

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[10] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[11] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[12] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[13] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[14], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

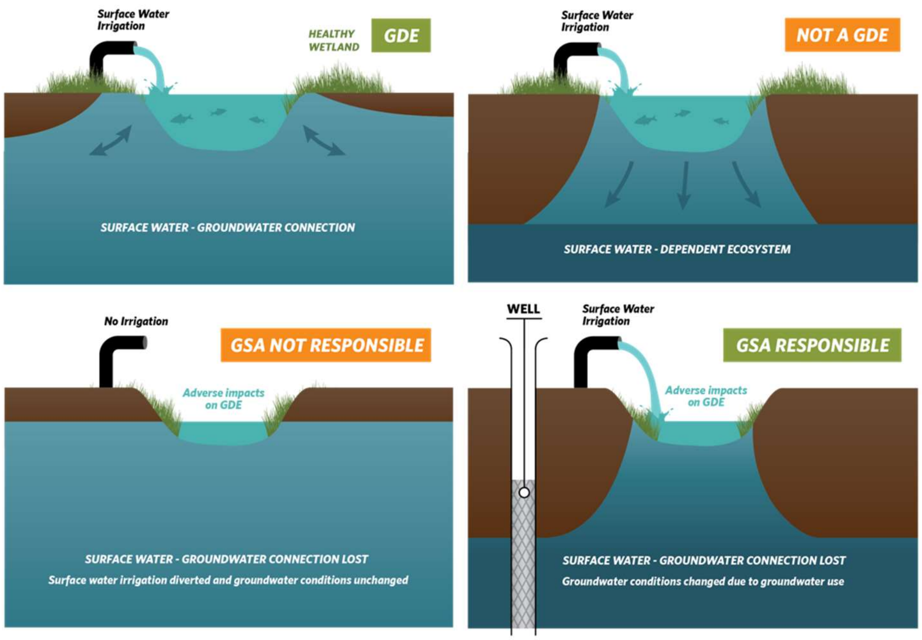

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[14] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

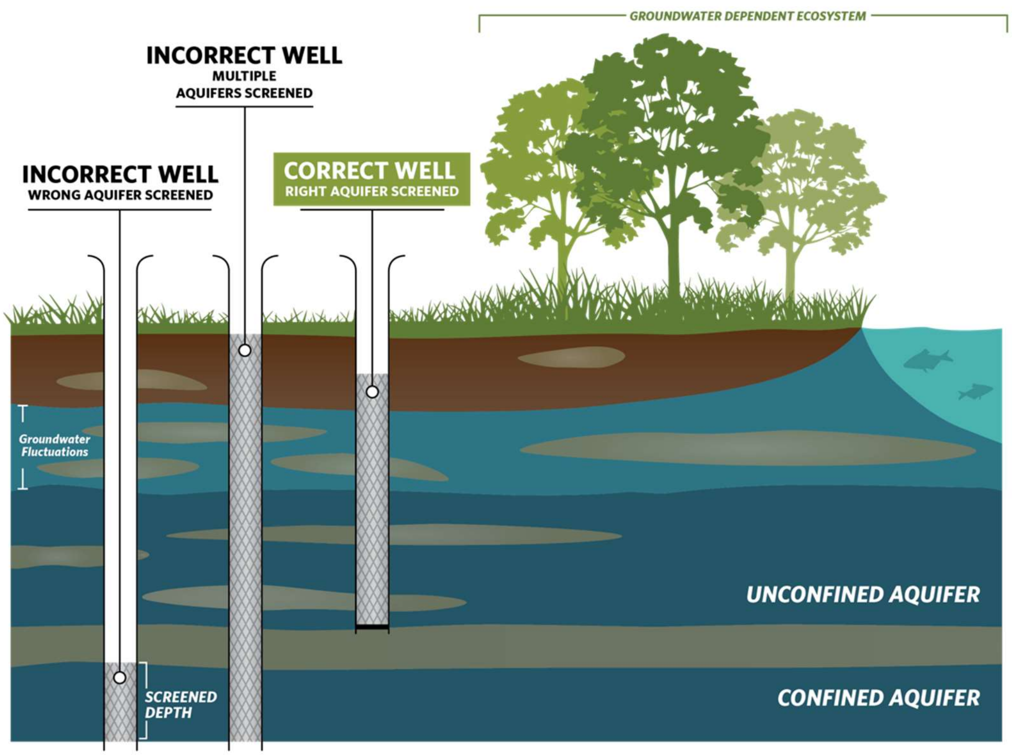


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[15] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

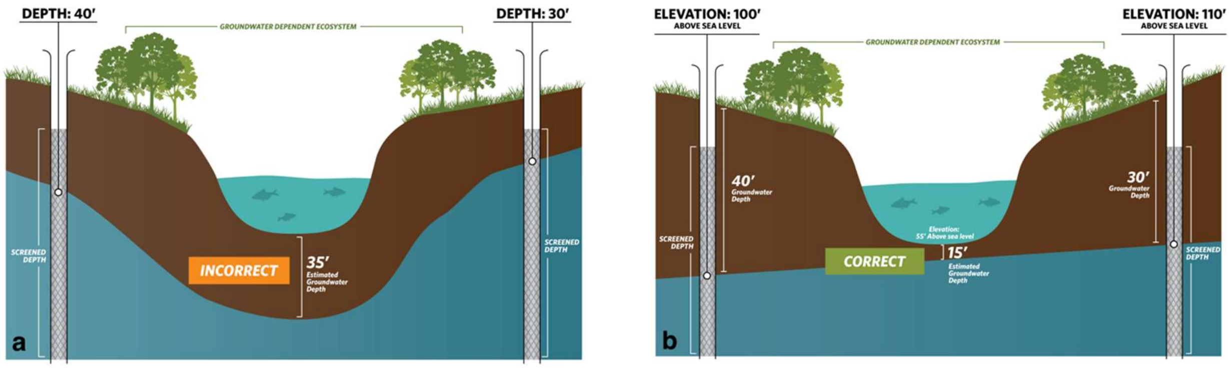


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

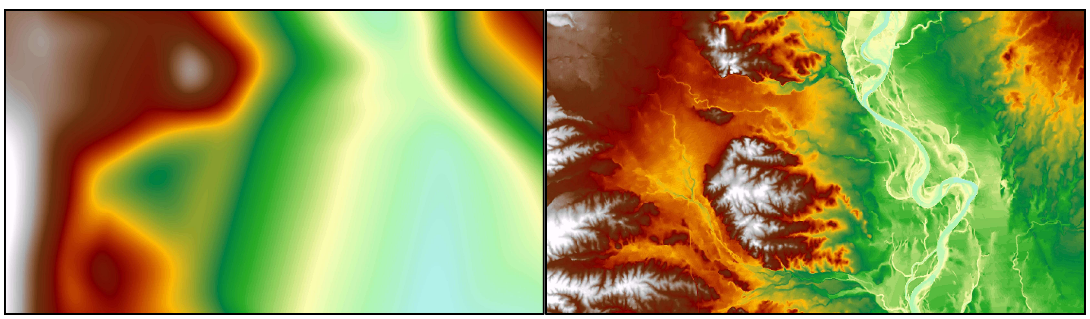


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[15] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

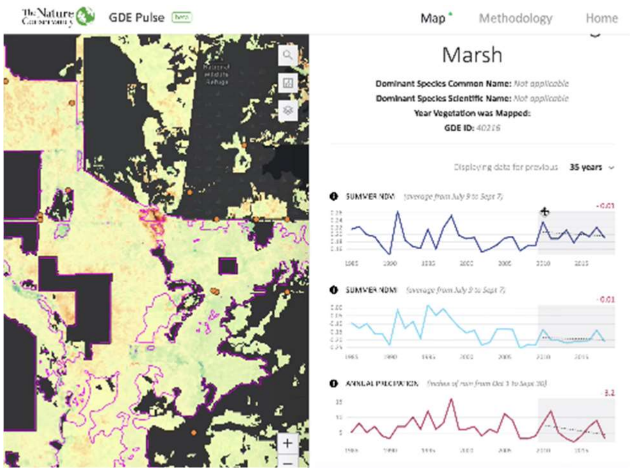
Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

The Nature Conservancy
Protecting nature. Preserving life.®

Visit
https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[16]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[17]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[16] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[17] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F

The GSA Response to TNC Comments on Draft GSP is located on the DWR SGMA portal as Part 2 of 2 of our comments.

Attachment G

Mapping Likely Interconnected Surface Water
The Nature Conservancy, California, May 2020

Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, ISW is defined as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:
The groundwater elevation data, available for Spring 2011-2012, and Spring and Fall 2013-2018, comes from the California Department of Water Resources (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). These data are represented as continuous raster layers that approximates "feet above or below mean sea level" based on groundwater well measurements. According to the documentation online, groundwater level measurements were selected based on measurement date and well construction information (where available) and are intended to approximate the groundwater levels in the unconfined to uppermost semi-confined aquifers. Each of the raster layer has a different extent, but all of them are limited to the Central Valley. To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

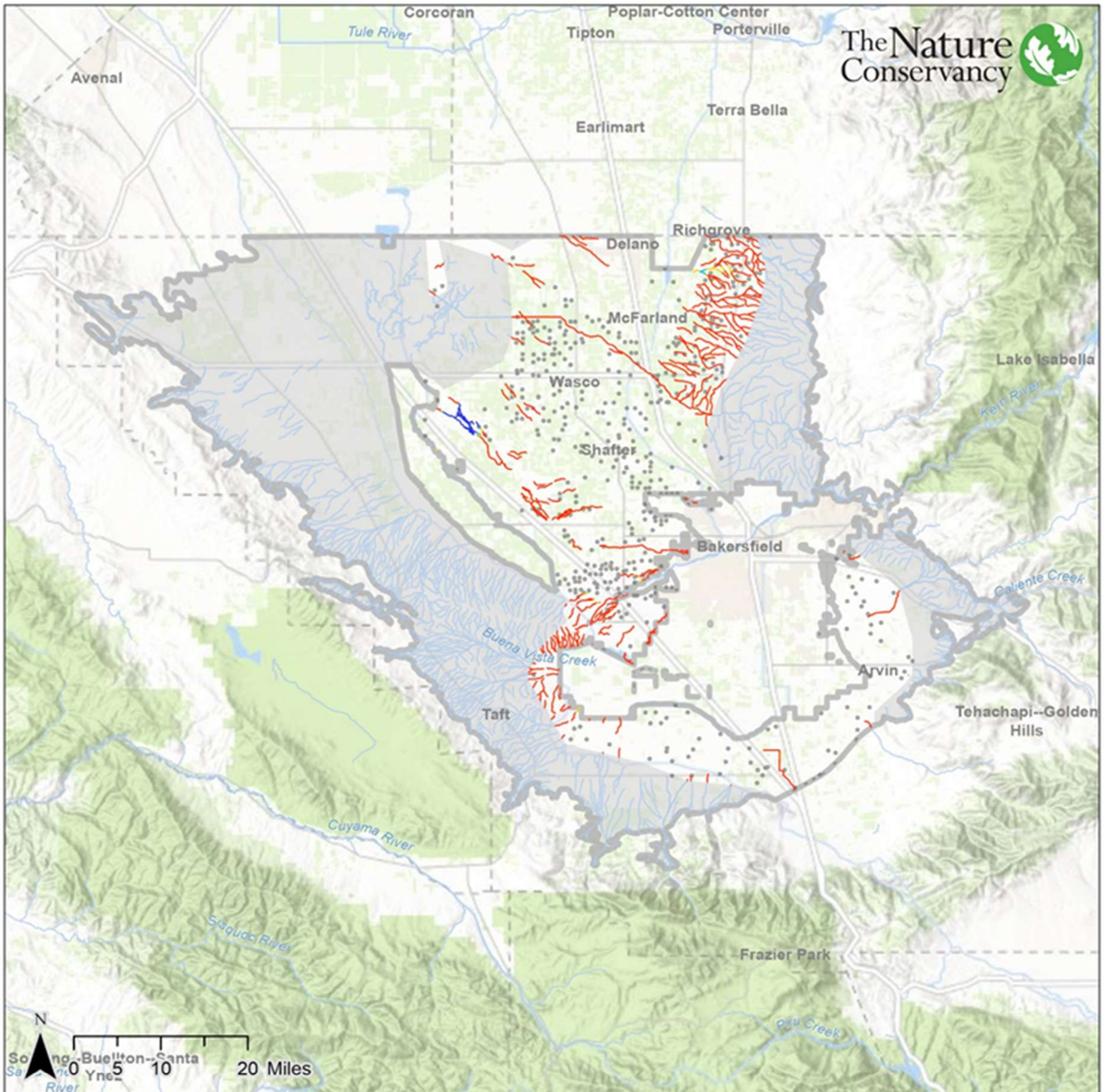
The map splits groundwater depth into four categories:

- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.
- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.

Interconnected Surface Water: Minimum Groundwater Depth (2011-2018)

Kern Groundwater Authority GSP



Legend

- Groundwater Sustainability Agency (GSA)
- No groundwater depth data available
- Rivers and streams with no depth data (1819 miles)
- Groundwater Elevation Monitoring Point

Minimum Groundwater Depth

- Connected - Gaining: Groundwater at or above stream surface (16.3 miles)
- Connected - Losing: Groundwater within 20 feet of stream surface (1.7 miles)
- Uncertain*: Groundwater within 20-50 feet of stream surface (7.5 miles)
- Likely Disconnected*: Groundwater greater than 50 feet below stream surface (369.3 miles)

**Streams could be connected to riparian or perched aquifers or shallow aquifers that are poorly characterized. More data are needed to confirm disconnected status.*

5-022.14_Kern_KernGroundwaterAuthority

Data Sources:
CA Dept. of Water Resources Groundwater Elevation Data, gis.water.ca.gov/app/gicima/
NHD Plus V2 Streams, nhdplus.com/NHDPlus/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[18]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[19]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[20] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[18] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[19] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[20] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Kings River East Groundwater Sustainability Plan (GSP), Kings Subbasin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Kings River East Groundwater Sustainability Agency's (GSA's) Kings River East Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing sustainable groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be insufficient in addressing environmental beneficial uses and users.

The identification of environmental beneficial users, as well as their consideration when establishing the sustainability goal, undesirable results, minimum thresholds and measurable objectives were insufficient (23 CCR §355.4(b)(4)) and lacked best available science (23 CCR §355.4(b)(1)). In the face of existing, severe overdraft, the GSP would allow groundwater management to largely ignore potential impacts to environmental beneficial users. This could result in irreparable harm to these beneficial users, undermining the intent of SGMA to achieve sustainability.

Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address within 180 days. In these cases, we strongly recommend that the Department, at a minimum, set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update. Should the treatment of environmental beneficial users be indicative of the quality of the overall plan, then we recommend the Department deem the plan inadequate.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides the GSA's response to TNC's comments on the Draft GSP. Attachment G provides a map and method summary of ISWs.

<u>Our Key Considerations</u>

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We are disappointed to see the feedback that we provided on the draft GSP have been largely ignored in the final plan, as only 6 out of 64 of our comments were adequately addressed in the Final GSP. This indicates poor engagement of environmental beneficial users, which undermines the intent of SGMA to ensure that sustainability be defined locally with the participation of all users. Based on our experience the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan" (23 CCR §355.4(b)(10)).

<u>TNC recommendation</u>: We strongly recommend that DWR require the GSA to prioritize stakeholder engagement through improvements to their stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters (ISWs) – The GSP incorrectly excluded potential and/or actual ISWs because the plan did not employ the best available science. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). ISWs were not consistently or adequately analyzed in the GSP. The GSP does recognize one reach of the Kings River than is in hydraulic connection to groundwater. However, the GSP does not explain how this interconnected reach was identified or estimate the quantity and timing of streamflow depletions. Our analysis of groundwater levels from 2011 to 2018 indicate ISWs are more extensive than estimated in the GSP, including all of the branches of the Kings river, portions of the Kings river downstream of Reedley, and Wahtoke Creek (see Attachment G). In addition, the plan does not consider the other streams in the subbasin. Furthermore, despite only two wells in the proposed monitoring network for ISWs, the GSP states that there are no data gaps in monitoring for ISWs. Therefore, potential ISWs may not be managed in the GSP.

<u>Map and Assessment of potential ISWs</u>:
By combining multiple years and seasons of groundwater depth data, The Nature Conservancy has determined that within the Kings River East GSP, 17.8 river miles are gaining, 51.5 are losing, and the rest are uncertain or likely disconnected (based on streams with available groundwater depth data). Attachment G contains a one-page method summary and a GSP-specific map of ISWs. The interconnected surface water displayed on the map is based on the

minimum groundwater depth estimated by the California Department of Water Resources between 2011 and 2018.

Note: In most cases, the groundwater depth data used to generate the ISW map does not include perched aquifers. As such, some streams marked as disconnected could in actuality, be connected.

<u>TNC recommendation</u>: Until a disconnection can be proven, TNC recommends that the GSP include all potential and confirmed ISWs. We recommend that the GSA conduct a thorough analysis of existing data on surface water-groundwater interconnectivity and estimate the quantity and timing of streamflow depletions in the subbasin. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 4,047 acres of potential GDEs occur in the GSA boundary. TNC developed the *Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs*[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

The plan does not to adequately identify, map and consider GDEs. We believe that this does not meet plan evaluation criteria (1), (4) and (10), as defined in the 23 CCR §355.4(b). In addition, the Plan does not satisfy the requirement to identify GDEs (23 CCR §Section 354.16(g)) and consider beneficial users throughout the plan. Our review found that NC Dataset polygons were improperly removed from the GDE map based on groundwater levels that were greater than 30-feet at a <u>single point in time</u>. This is a technically incorrect approach since groundwater levels fluctuate over seasonal and interannual time scales due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Justifying the removal of NC dataset polygons solely based on this criterion does not acknowledge that groundwater levels temporally vary and the fact that many plant species within GDEs can access groundwater depths beyond 30-ft or have adapted water stress strategies to deal with intermittent periods of deep groundwater levels. Using this methodology disregards groundwater fluctuations and can leave many GDEs unprotected in the GSP.

<u>TNC recommendation</u>: TNC recommends that the GSA utilize groundwater levels that represent interannual and inter-seasonal variability along with additional information provided in Attachment D on best practices for utilizing the NC dataset to identify and consider GDEs throughout the GSP. Specifically, the GSA should use a Digital Elevation Model (DEM) when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment D.

Water Budget – We were disappointed to see that the water budget did not include the current, historical and projected demands of native vegetation and managed wetlands, as required under SGMA (23 CCR §354.18(a) and (b)(3)). The GSP only focused on a subset of water use sectors, including urban and agricultural users of groundwater. This is problematic because key environmental uses of groundwater are not being accounted for as water supply

[1] *Available at:* https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

decisions are made using this budget nor will they likely be considered in project and management actions.

TNC recommendation: As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget.

Sustainable Management Criteria – Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. As a result, the monitoring network does not adequately characterize GDEs and other environmental beneficial users of surface water and groundwater. Potential GDEs are located along surface water bodies where no shallow groundwater monitoring currently exists or is proposed, leaving data gaps unfilled. Potential ISWs have been dismissed in the GSP, without proposed recommendations to improve ISW identification, mapping, and estimates of depletions. Therefore, GDEs and ISWs are not being specifically addressed by the monitoring network in the GSP.

TNC recommendation: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess potential impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but sustainable groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Kings River East Groundwater Sustainability Plan
Comments based on Draft and Final GSPs

The Kings River East Area Groundwater Sustainability Plan (GSP) adopted December 13, 2019 was reviewed by TNC. Public draft GSP comments and responses, provided as Appendix 8A of the GSP, were reviewed and are referred to below. The TNC comments and responses are also provided in Attachment F of this letter. This attachment lists our original comments on the complete public draft GSP as submitted to the GSA during the public comment period, and states whether or not they were addressed in the final GSP [as green text within brackets]. Comments are provided in the order of the checklist items included as Attachment A.

Overall Comment on the GSP

- *[The GSP is improved in this regard but there are still figures missing and incorrect callouts. See individual comments below for specific issues.]* Key sections of the document were not provided in the public draft, such as the map of GDE areas and Sustainable Management Criteria for Interconnected Surface Waters. **Please carefully check the document for completeness, missing figures, missing figure references, mis-labeled figures, and formatting. Where pertinent to our review, specific issues are called out below.**

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

[Section 2.5.1 Description of Beneficial Uses and Users (p. 2-34)]

- *[The GSA's response of "Thank you for your comments. All comments are given due consideration" does not address our comment and no changes to the GSP text were made.]* The discussion of beneficial uses and users of groundwater focuses on agricultural users, public and private water supply systems, and disadvantaged communities. The GSP states (p. 2-34): "KREGSA is not aware of any environmental users of groundwater within KREGSA." There are riparian areas along the Kings River where wildlife is supported by the river and shallow groundwater. In addition, possible GDEs have been identified in the KREGSA. **Please discuss if any environmental groups were engaged during the GSP development process. Acknowledge that there are environmental users of groundwater including GDEs and those supported by ISWs.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please identify whether or not the following beneficial uses and users of groundwater in the Subbasin are present: Protected Lands, including refuges, conservation areas, and recreational areas; and Public Trust Uses, including wildlife, aquatic habitat, fisheries, and recreation.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The types and locations of environmental uses, species and habitats supported, instream flow requirements, and other designated beneficial

environmental uses of surface waters that may be affected by groundwater extraction in the Subbasin should be specified. **To identify environmental users, please refer to the following:**

- The NC Dataset (https://gis.water.ca.gov/app/NCDatasetViewer/) which identifies the potential presence of groundwater dependent ecosystems in this basin.
- The list of freshwater species located in the Kings Subbasin in Attachment C of this letter. Please take particular note of the species with protected status.
- CDFW's California Natural Diversity Database (CNDDB) - https://www.wildlife.ca.gov/Data/CNDDB
- USFWS's IPAC report for the KREGSA - https://ecos.fws.gov/ipac/

Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8).

[Section 2.2.1 Groundwater Level Monitoring (p. 2-18)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The Kings River Conservation District (KRCD) oversees groundwater level data collection in the KREGSA. **Please describe how existing groundwater monitoring programs are protective of GDEs or propose additional monitoring that specifically targets GDEs.**

[Section 2.2.9 Surface Water Monitoring (p. 2-22)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This section states that the Kings River is monitored by the Kings River Water Association, with emphasis on snowpack and reservoir inflows and outflows. There is no mention that the Kings River flow requirements include maintenance of a 10 percent minimum capacity in the Pine Flats Reservoir for improved temperature control and year-round fish releases below the reservoir. There is no mention of ISWs or GDEs or how they are monitored. **Please explain the relationship of existing stream flow monitoring to the protection of ISWs and GDEs.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The GSP discusses the uncertainty of Kings River flood flows in the future. The SWRCB has declared the Kings River to be a "fully appropriated stream" (p. 2-23). This status has been challenged by the Semitropic Water Storage District of Kern County. Flood flows of the Kings River could be transferred out of the subbasin into Kern County. **Please discuss how this transfer, if it occurs, could impact the GDEs and ISWs in the KREGSA.**

[Section 2.3.1 Summary of General Plans (p. 2-25)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The Fresno and Tulare County General Plan and the City General Plans of Dinuba, Orange Cove, and Reedley were adopted prior to the development of the GSP. This section should be modified to include a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals. **Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs.**

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin and if they are associated with critical, GDE or ISW habitats. **Please identify all relevant HCPs and NCCPs within the Subbasin, and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Please refer to the Critical Species Lookbook[2] to review and discuss the potential groundwater reliance of critical species in the basin. **Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.**

[Section 2.3.4 Permitting New or Replacement Wells (p. 2-26 to 2-28)]

- *[Our comment was adequately addressed through GSP text changes. Thank you for acknowledging the environmental importance of proper well permitting and coordination with the GSP to ensure sustainable groundwater management.]* Well permitting is currently managed by the Fresno and Tulare County Health Departments. Both counties require new, repaired or replacement wells to have a permit and require adherence to DWR standards. **Please include a discussion of how future well permitting will be coordinated with the GSP to assure achievement of the Plan's sustainability goals.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF vs. SWRCB and Siskiyou County, No. C083239). **Compliance of well permitting programs with this requirement should be stated in the GSP.**

<u>Checklist Items 5, 6, and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)</u>

[Section 3 Basin Setting (p. 3-1 to 3-125)]

- *[The GSP improved the figures in this section but there are still problems with the callouts. For example, on page 3-79 the callout for Figure 3-31 should be to Figure 3-35. Please re-check all figures and callouts in this section.]* There are several problems with figures in Section 3. The numbering is off by one, beginning on page 3-31, when the text refers to Figures 3-15 to 3-20, but the numbers should be Figures 3-16 to Fig 3-21. The figure after page 3-43 has no number. It is referred to both as Figure 3-21 and 3-22. Figure 3-22 numbering is probably correct, but it does not show all the rivers and creeks listed in the text. The land subsidence section refers to Figure 3-25, which has the KRCD subsidence monitoring locations

[2] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

on it, but is included later as Figure 3-29 after page 3-70. Figure 3-26 is not mentioned at all. Figure 3-27 (NASA 2015-1017 lnSar data provided by DWR) is missing. Figure 3-28 (GDE map with included and excluded units) referenced on page 3-70 is missing. **Please provide missing figures and check numbering of all figures in Section 3.**

[Section 3.1.3 Regional Geologic and Structural Setting (p. 3-4 to 3-7)]

- *[The GSA's response does not address our comment. Changes were made to the GSP text but our comment was not addressed.]* In the eastern part of the KRE GSA, the base of the aquifer is defined by the bedrock. In the western part, the bedrock is deeper as shown in Figure 3-3. The base of the usable aquifer corresponds with the base of freshwater, generally defined as groundwater with total dissolved solids (TDS) of 2,000 milligrams per liter (mg/l), consistent with other GSAs in the Kings subbasin. As noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** Properly defining the bottom of the basin will prevent the possibility of extractors with wells deeper than the basin boundary from claiming exemption from SGMA due to their well residing outside the vertical extent of the basin boundary.

[Section 3.1.7 Cross-Sections (p. 3-20 to 3-35)]

- *[The GSP figure numbers in this section were updated. Other requested figure changes were not made.]* The cross-sections across the Kings River East depict the general types of formation (e.g., sand or clay) and the water surface based on the Fall 2013 level, but do not show the base of freshwater. In cross-section C-C', there were two composite wells, AR No, 4 and Kingsburg No. 12, with multiple screened intervals, so the water level does not represent the shallowest groundwater. Cross-sections B-B' and C-C' are mis-labeled; B-B' should be Figure 3-14 and C-C' should be Figure 3-15. **Please correct the figure number labels and add the base of freshwater where pertinent to these cross-sections.**
- *[The GSA's response does not address our comment and no changes to the GSP figures were made.]* The basin-wide cross sections provided in Figures 3-15 through 3-20 are regional, and do not include a graphical representation of the manner in which shallow groundwater may interact with ISWs or GDEs that would allow the reader to understand this topic. The cross-sections have been taken from a 1969 source and, as reproduced in the GSP, are very difficult to read and understand. **Please reproduce the regional cross-sections so that they can be understood by the reader and update them to illustrate data obtained from more recent well installations. Include an example near-surface cross sections that depicts the conceptual understanding of shallow groundwater and river interactions at different locations, as well as any potential GDEs and ISWs**.

[Section 3.1.8.4 Confining Beds (p. 3-44)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The Corcoran Clay is present in the southwestern part of the subbasin. There are local confining beds at depths of 200 to 300 feet in the basin. Some recent irrigation wells have been screened in the deep confined groundwater. This section appears to contradict the sentence on page 3-105 which states "There are no known confined aquifers in KREGSA," and in Section 5 Monitoring Network, where the GSP states that there is "a confined aquifer covering a smaller portion of the southwestern edge of KREGSA" (p. 5-7). **Please revise the text in Section 3 and provide additional discussion and reference a map to explain where the wells screened in confined groundwater are located.**

[Section 3.1.10 Surface Water Features (p. 3-45)]

- *[The GSP figure was revised to incorporate our comments. Thank you for showing these important surface water features on this map.]* This section discusses the major river in the KREGSA, the Kings River, and shows the river and the major diversions on Figure 3-23. The other creeks are mentioned in the text, but are not shown in the figure. The canal system of the Alta Irrigation District is also mentioned, as is the Cobbles Weir. The weirs shown on the map include one for a diversion out of subbasin, shown in red, which is not used. **Please revise the figure to show all the creeks, the canals of Alta ID including the Cobbles Weir, Fresno Weir, and Peoples Weir, other weirs from Kings River and the Friant-Kern Canal.**

[Section 3.1.12 Recharge and Discharge Areas (p. 3-48 to 3-53]

- *[A description and figure of wetland areas was added to the GSP text. Please further describe these areas and state whether features are present that attract wildlife and if habitat could be included in an HCP or NCCP.]* The GSP states that there are intentional recharge basins. No specific names of recharge basins are given here or noted in the water budget section. **Please include the names and description of these areas and if they note whether any features are present that attract wildlife. Please indicate whether the recharge basins are or could be operated as multiple-benefit projects that provide habitat suitable for migrating birds or other species, and could be included in an HCP or NCCP.**
- *[The revised GSP text refers to Figure 3-28 in this section for groundwater discharge areas but they are not evident on the figure. Our comment was not addressed.]* **Please include missing Figure 3-24, which shows the locations of groundwater discharge areas.**

<u>Checklist Items 8, 9, and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)</u>

[Section 3.2.10 Interconnected Surface Water Systems (p. 3-79)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The Interconnected Surface Water Systems section appears to be incomplete. The text states that shallow groundwater is in hydraulic communication with stream flow in the Kings River upstream of the city of Reedley, but gives no further details. Other Kings Basins GSPs (for example, Central Kings and North Kings) discuss the draft HCM and Groundwater Conditions report for the Kings River area prepared by KDSA 2017. **Please further describe the ISWs in the KREGSA citing this report and other available information. Per the regulations cited on page 3-69 of the GSP, estimate the quantity and timing of depletion of those systems, utilizing best available information.**

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please note the following best practices for analysis of ISWs.** ISWs are best estimated by first determining which reaches are completely disconnected from groundwater. This approach would involve comparing groundwater elevations with a land surface Digital Elevation Model (DEM) that could identify which surface waters have groundwater consistently below surface water features, such that an unsaturated zone would separate surface water from groundwater. **Please provide or refer to depth to groundwater contour maps in this section. See Attachment D for best practices for completing this step. Specifically, ensure that the first step is contouring groundwater elevations, and the subtracting this layer from land surface elevations from a DEM to estimate depth to groundwater contours across the landscape**. This will provide much more accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. Contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make.
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The finding that groundwater is in direct hydraulic communication with streamflow in the Kings River cited by KDSA 2017 in other Kings Basin GSPs should be illustrated using cross-sections with measured channel bed elevations and depths to groundwater. **Please provide a cross-section to show the relationship between the depth to groundwater and the bed of the river channel. If channel bed elevations are not known, please identify as a data gap and further discuss in the Monitoring section of the GSP.**

<u>Checklist Items 11 to 15, Identifying and Mapping GDEs (23 CCR §354.16)</u>

[Section 3.2.11 Groundwater Dependent Ecosystems (p. 3-79)]

- *[Figures 3-34 and 3-35 were provided in the Final GSP showing GDEs in the KREGSA. Thank you for providing these figures in the Final GSP. Our comment was addressed.]* The GSP has a brief discussion of GDEs that follows the discussion of GDEs from other GSAs in the Kings Subbasin. However, the referenced Figure 3-28 is missing. The comments that follow instead refer to Figure 3-58 from the Central Kings GSP, since this figure also shows GDEs in the KREGSA. **The comments on this section should therefore be considered preliminary until a final Figure for GDEs in the KREGSA is provided.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The NC dataset is a starting point for GSAs to identify GDEs in their basin/subbasin. The NC dataset has 4,047 acres of potential GDEs mapped within the

KREGSA, representing a significant amount of GDEs to be considered. Note that this is a starting point, thus not all potential GDEs are mapped and not all ecosystems mapped are GDEs. **Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled by the monitoring network.** Specifically, please note:

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The text refers to Spring of 2017 depth to groundwater contours. **Please provide more information on how these contours were developed, and note the following best practices for developing depth to groundwater contours**:
  - Only wells monitoring the upper unconfined aquifer are being used to verify whether polygons in the NC dataset are supported by groundwater;
  - The wells used for interpolating depth to groundwater sufficiently close (<5km) to NC Dataset polygons reflect local conditions relevant to ecosystems;
  - The wells used for interpolating depth to groundwater are screened within the surficial unconfined aquifer and capable of measuring the true water table; and
  - Depth to groundwater is contoured using groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a DEM to estimate depth to groundwater contours across the landscape. This will provide much more accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from measurements at wells assume that the land surface is constant, which is a poor assumption to make. It is better to assume that water surface elevations are constant in between wells, and then calculate depth to groundwater using a DEM of the land surface to create the contour map.
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Spring 2017 is after the SGMA benchmark date of January 1, 2015. **Ensure that groundwater condition data prior to the SGMA benchmark date of January 1, 2015 is included in the analysis.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* It is highly advised that seasonal and interannual groundwater fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one point in time (e.g., Spring 2017) can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. **We highly recommend using depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine**

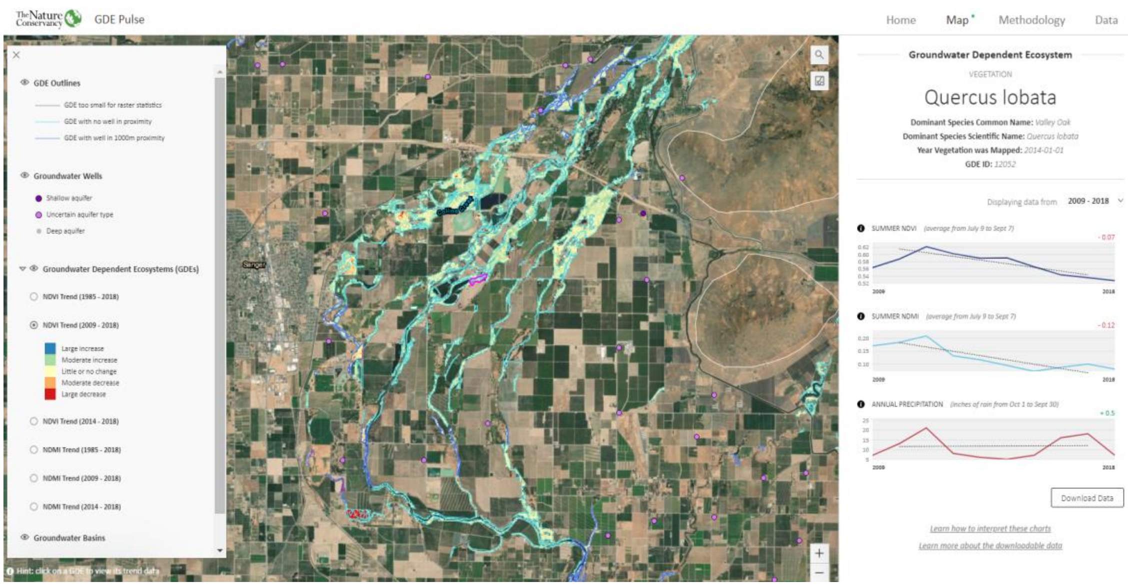
the range of depth to groundwater around NC dataset polygons. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network.

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please provide rationale for the 30-foot criteria cited in the text.** The text states (p. 3-69): "Recognizing that much of the Kings Subbasin has a depth to groundwater greater than the deepest vegetative GDE rooting depth of thirty feet, many of the GDEs identified in the NC Dataset Viewer were mischaracterized." In TNC's GDE Guidance, the depth criteria of 30 feet is presented as a criterion for *inclusion*, not a standalone criterion for *exclusion*. In other words, if groundwater is within 30 feet of the ground surface, then a GDE can be identified. If it is not, then further analysis must be conducted (see Appendix III of the GDE Guidance, Worksheet 1, for other indicators of GDEs). **Please indicate what vegetation is present in the possible GDEs.** The actual rooting depth of vegetation growing in the area should be considered, and this will vary by species dominance and habitats present. For example, some phreatophytes can root to 120-feet deep in more arid and drought stressed environments. Furthermore, rooting depths are likely to spatially vary based on the local hydrologic conditions available to the plant. Maximum rooting depths do not take capillary action into consideration, which will vary with soil type and is an important consideration since woody phreatophytes generally do not prefer to have their roots submerged in groundwater for extended periods of time, and hence can access groundwater at deeper depths.
- *[One sentence added to GSP text: "This 100-ft buffer is based on a California Department of Transportation typical wetland setback (CDOT, 2019)." However, this addition to the text does not address our comment nor does this buffer rule describe whether groundwater conditions in the basin are supporting GDEs.]* The text states: "The Kings Subbasin also categorized GDEs within 100 feet of the Kings River and the San Joaquin River as "Possible GDEs." **Please clarify how the 100-foot buffer was used to include or exclude GDEs in the KREGSA area, and how this is supported by groundwater level and plant physiological data. If there is a potential GDE near the river, we suggest the entire GDE is included, rather than using an arbitrary 100-foot cutoff.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **In the text, please cite the acreage of GDEs retained and removed. The basin's GDE shapefile, which is submitted via the SGMA Portal, should include two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).**

Checklist Items 16 to 20, Describing GDEs (23 CCR §354.16)

[Section 3.2.11 Groundwater Dependent Ecosystems (p. 3-79)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please provide information on the historical or current groundwater conditions in the GDEs or the ecological conditions present**. Refer to GDE Pulse (https://gde.codefornature.org; See Attachment E of this letter for more details) or any other locally available data to describe depth to groundwater trends in and around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in the KREGSA:



- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please provide an ecological inventory (see Appendix III, Worksheet 2 of the GDE Guidance) for all potential GDEs that includes the vegetation types or habitat types and rank the GDEs as having a high, moderate or low value; and what characterizes the rank.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat, were found in or near any of the GDEs, since some organisms rely on uplands and wetlands during different stages of their lifecycle**. Resources for this include the list of freshwater species located in the Kings Subbasin that can be found in Attachment C of this letter, the Critical Species Lookbook, and CDFW's CNDDB database.

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **For each identifiable GDE unit with supporting hydrological datasets please include the following:**
    - Plot and provide hydrological datasets for each GDE.
    - Define the baseline period in the hydrologic data.
    - Classify GDE units as having high, moderate, or low susceptibility to changes in groundwater.
    - Explore cause-and-effect relationships between groundwater changes and GDEs.
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **For each identifiable GDE unit without supporting hydrological datasets please describe data gaps and/or insufficiencies.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Compile and synthesize biological data for each GDE unit by including:**
    - Plots of biological datasets for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.
    - Describe data gaps/insufficiencies.
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Describe potential effects on GDEs, land uses, and property interests, including:**
    - Cause-and-effect relationships between GDE and groundwater conditions.
    - Impacts to GDEs that are considered to be "significant and unreasonable".
    - Report known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities.
    - Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).
    - Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.

<u>Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)</u>

[Section 3.3.8 Historical Water Budget (p. 3-106)]
[Section 3.3.9 Current Water Budget (p. 3-110)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please clarify whether a term is included for native or riparian vegetation evapotranspiration in the KREGSA historical, current, and projected water budgets.**

[Section 3.3.10 Projected Water Budget (p. 3-114)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Given the uncertainty associated with Kings River water supply into the future, the assumption was made that the historical water delivery from the Kings

River would be maintained. This assumption is highly uncertain and is not conservative. The diversion of Kings River flows may require additional provision for storage in the non-irrigation or low-irrigation season. **Please add discussion of the potential impacts to the flow in the Kings River and to groundwater conditions on GDEs, aquatic ecosystems and instream flow requirements due to climate change.**

Checklist Items 23 to 25 – Sustainability Goal (23 CCR §354.24)

[Section 4.1 Sustainability Goal (p. 4-2)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Since GDEs are present in the KREGSA, they should be recognized as beneficial users of groundwater and should be included in the Sustainability Goal. In addition, a statement about any intention to address pre-SGMA impacts should be included.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* GDEs are dependent, in part, on suitable water quality; however, the GSP only considers water quality for irrigation and domestic use. **TNC recommends including ISWs and their potential GDEs in the sustainability goal and criteria. Since GDEs may be affected by water quality, they should be included in the Sustainability Goal.**

Checklist Item 26 – Measurable Objectives (23 CCR §354.30)

[Sections 4.2.3 Measurable Objectives for Groundwater Levels (p. 4-20)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This Measurable Objective does not consider GDEs. GDEs are often adjacent to streams or associated with riparian corridors where ISWs exist, even if only seasonally or discontinuously along a longitudinal or lateral profile. **Please include GDEs (see comments under Checklist Items 8-10) in this section and state whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Sections 4.5.3 Measurable Objectives for Water Quality (p. 4-41)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This Measurable Objective does not consider water quality needs of GDEs. **Please include a discussion about GDEs and water quality and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Section 4.7.3 Measurable Objectives for Interconnected Surface Water (p. 4-70)]

- *[This previously missing section was added to the document.   However, Sustainable Management Criteria were not set for ISWs, so our original bolded comment still applies.]* The Sustainable Management Criteria section for Interconnected Surface Water is missing from the document. **Because ISWs exist in the KREGSA,**

Sustainable Management Criteria must be developed for this sustainability indicator.

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The text states (p. 4-9): "Water levels will not be used as proxy for the other sustainability indicators." However, the text also states (p. 5-43): "Water level will be used as a proxy for the interconnected surface water sustainability indicator." Furthermore, in the Monitoring section, the GSP states (p. 5-39): "The groundwater level minimum threshold elevations in the indicator wells (Section 4.2) in the area of the Kings River below the Fresno Weir were used to determine the sustainable management criteria for interconnected surface water," implying that groundwater elevations are used as a proxy for the depletion of surface water suitability indicator. **Please clear up these apparent inconsistencies in the text.**

Checklist Item 27-29 – Minimum Thresholds (23 CCR §354.28)

[Sections 4.2.2 Minimum Thresholds for Groundwater Levels (p. 4-8)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This Minimum Threshold does not consider GDEs or ISWs. **Please include GDEs and ISWs in this section and discuss whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Sections 4.5.2 Minimum Thresholds for Groundwater Quality (p. 4-36)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This Minimum Threshold does not consider water quality needs of GDEs. **Please include a discussion about GDEs and water quality and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Section 4.7.2 Minimum Thresholds for Interconnected Surface Water]

- *[This previously missing section was added to the document. However, Sustainable Management Criteria were not set for ISWs, so our original bolded comment still applies.]* As stated above, the Sustainable Management Criteria section for Interconnected Surface Water is missing from the document. **Because ISWs exist in the KREGSA, Sustainable Management Criteria must be developed for this sustainability indicator.**

Checklist Item 30-46 – Undesirable Results (23 CCR §354.26)

[Section 4.2.1 Undesirable Results for Groundwater Levels (p. 4-4)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This section only describes undesirable results relating to human beneficial uses of groundwater and neglects environmental beneficial uses and users that could be adversely affected by chronic groundwater level decline. **Please add**

potential adverse impacts to GDEs and native freshwater species to the discussion of potential undesirable results presented in this section.

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The GDE Pulse web application developed by TNC provides easy access to 35 years of satellite data to view trends of vegetation metrics, groundwater depth (where available), and precipitation data. This satellite imagery can be used to observe trends for NC dataset polygons within and near the GSA. Over the past 10 years (2009-2018), some NC dataset vegetation polygons have experienced adverse impacts to vegetation growth and moisture along the Kings River. An example screen shot from the GDE Pulse tool is presented under Checklist Items 11-15 above.

[Section 4.5.1 Undesirable Results for Groundwater Quality (p. 4-32)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This section describes undesirable results in terms of meeting drinking water standards and irrigation water quality. **Any potential undesirable results from degradation of water quality that may impact GDEs and freshwater species in the area should be discussed in this section.**

[Section 4.7.1 Undesirable Results for Interconnected Surface Water]

- *[This previously missing section was added to the document. However, Sustainable Management Criteria were not set for ISWs, so our original bolded comment still applies.]* As stated above, the Sustainable Management Criteria section for Interconnected Surface Water is missing from the document. **Because ISWs exist in the KREGSA, Sustainable Management Criteria must be developed for this sustainability indicator.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The analysis of ISWs should include all beneficial uses and users of surface water that could be affected by groundwater withdrawals, including environmental users. **Please state in this section whether there are any instream flow requirements and critical habitat designations and set measurable objectives and interim milestones to help achieve the sustainability goal as it pertains to the environment.**

<u>Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)</u>

[Section 5.2 Groundwater Level Monitoring (p. 5-6 to 5-16)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please address how the requirement to link and correlate groundwater level declines to biological responses and significant and adverse impacts to GDEs and ISWs will be addressed by the monitoring network.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The proposed 22 wells to be used for monitoring groundwater levels are shown on Figure 5-2 (p. 5-5). However, there is no indication on the figure which wells have well construction information. Some of the wells used in the cross-

sections had multiple screened intervals and some had deep screened intervals, which make them unsuitable as unconfined groundwater monitoring sites. The text states that where well information is not obtained, other wells may be selected by 2025. **Please elaborate on plans to collect well construction information as soon as possible. To accurately characterize GDEs, please clarify how the unconfined aquifer will be monitored and how many wells will be used.**

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* In Section 5.2.8.2 Identification of Data Gaps (p. 5-14), the text refers to the NKGSA instead of the KREGSA and mentions a spatial data gap along the eastern part of Highway 68. There are apparent spatial data gaps in the southwest part of the KREGSA west and south of Traver and to the northeast of Reedley. **Please provide discussion of the spatial data gaps in the monitoring network for the KREGSA and how they will be filled.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Possible GDEs were identified along the foothills and within 100 feet of the Kings River. **To accurately characterize GDEs, please describe how the unconfined aquifer will be monitored and how many wells will be used. Please clarify how many of the wells on Figure 5-2 represent the unconfined aquifer.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The text mentions that the GSA seeks to refine the understanding of a confined aquifer due to multiple clay layers in the eastern area where the Corcoran Clay is absent. The monitoring program may be expanded in the future, if there are sufficient wells tapping the confined aquifer, such that two monitoring programs for the unconfined aquifer and the confined aquifer would be established. **Please identify any existing wells in the known confined aquifer and at what depths confined conditions are understood to exist.**

[Section 5.7 Depletion of Interconnected Surface Water Monitoring (pp. 5-39 to 5-45)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater ***and related surface conditions*** (emphasis added). Groundwater level monitoring alone may be insufficient to establish a linkage between groundwater extraction and potentially resulting impacts to environmental resources associated with GDEs and ISWs. The cause-effect relationship between groundwater levels and the biological responses that could result in significant and unreasonable impacts to ISWs and GDEs depends on a number of complicated factors, and this relationship is not characterized or discussed. As such, it is not possible to determine whether the proposed monitoring is sufficiently protective to ensure significant and unreasonable impacts to GDEs and ISWs will be prevented. **To clarify if GDEs are present, consider adding monitoring of potential GDEs at any locations where ISWs are present regardless of their seasonal or discontinuous nature.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The wells shown in Figure 5-2 include two wells that have been identified to monitor unconfined groundwater in the vicinity of the interconnected

portion of the Kings River. These wells are KRWD04 and B013B. The location of the river channels and sloughs and the location of the Fresno Weir are not shown on this map, so it is difficult to tell how far the wells are from the river. In addition, the depth and screened interval are not provided for the two wells. Thus, it is not possible to determine if the monitoring is adequate. In the text (p. 5-41) a Figure 5-4 was referenced but not included. **Please provide the missing figure and a description of any sites where flow and channel depth will be measured. Please provide well construction information for these two wells and distances from the river. Please show the river channel depth and location in reference to these wells, along with the screened interval of the wells.**

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This section is entitled "Depletion of Interconnected Surface Water Monitoring," however the GSP states (p. 5-45): "There are no identified data gaps in the groundwater *quality* (emphasis added) monitoring network at this time." Please identify data gaps in the monitoring of ISWs. **Please reconcile the limited monitoring for ISWs with specific recommendations (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features to improve ISW mapping and inform an adequate analysis.**

<u>Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)</u>

[Section 6.1 Introduction (p. 6-1)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The KREGSA includes GDEs and ISWs (see our comments under Checklist Items 8-10 and 16-20 above) that are beneficial uses and users of groundwater and may include potentially sensitive resources and protected lands. Environmental beneficial users and uses should be considered in establishing project priorities. In addition, consistent with existing grant and funding guidelines for SGMA-related work, consideration should be given to multi-benefit projects that can address water quantity as well as providing environmental benefits or benefits to disadvantaged communities. **Please include environmental benefits and multiple benefits as criteria for assessing project priorities.**

[Section 6.2 Projects (pp. 6-2 to 6-34)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This section identifies multiple recharge projects; however, the descriptions of Measurable Objectives for these projects only identifies benefits to water level, groundwater storage, and degraded water quality. In most cases, the water source and the funding have not been identified, increasing the uncertainty of the project being implemented. Because maintenance or recovery of groundwater levels or construction of recharge facilities may have potential environmental benefits, it would be advantageous to demonstrate multiple benefits from a funding and prioritization perspective.

- **For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.**
- If ISWs will not be adequately protected by those listed, **please include and describe additional management actions and projects targeted for protecting ISWs.**
- Recharge basins, reservoirs and facilities for managed stormwater recharge projects can be designed as multi-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such multiple-benefit projects and facilities have been incorporated into local Habitat Conservation Plans (HCPs) and Natural Community Conservation Plans (NCCPs), more fully recognizing the value of the habitat that they provide and the species they support. For projects that construct recharge basins, **please consider identifying if there is habitat value incorporated into the design and how the recharge basins will be managed to benefit environmental users. Grant and funding priorities for SGMA-related work may be given to multi-benefit projects that can address water quantity as well as provide environmental benefits. Therefore, please include environmental benefits and multiple benefits as criteria for assessing project priorities.**
- For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

[Section 6.3 Management Actions (p. 6-35)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The KREGSA has listed possible management actions in Table 6-16. These actions include education and communication, improved documentation of groundwater extraction facilities, and other methods for quantifying groundwater extraction. **Please consider adding Management Actions which include education and outreach for protection of GDEs and ISWs as well as specific management of these ecosystems and the species they provide for.**

Attachment C

Freshwater Species Located in the Kings Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Kings Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[3]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[4] as well as on TNC's science website[5].

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Birds				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	BCC	SCC	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		SCC	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		SCC	

[3] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[4] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[5] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		SCC	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cypseloides niger	Black Swift	BCC	SCC	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	BCC	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	BCC	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		SSC	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			

Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		SSC	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		SSC	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		SSC	BSSC - Third priority
Crustaceans				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	SSC	IUCN - Vulnerable
Branchinecta mesovallensis	Midvalley Fairy Shrimp		SSC	
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	SSC	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		SSC	IUCN - Near Threatened
Fishes				
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Cottus asper ssp. 1	Prickly sculpin			Least Concern - Moyle 2013
Cottus gulosus	Riffle sculpin		SSC	Near-Threatened - Moyle 2013
Gasterosteus aculeatus microcephalus	Inland threespine stickleback		SSC	Least Concern - Moyle 2013

Lampetra hubbsi	Kern brook lamprey		SSC	Vulnerable - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		SSC	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		SSC	Near-Threatened - Moyle 2013
Mylopharodon conocephalus	Hardhead		SSC	Near-Threatened - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus tshawytscha - CV fall	Central Valley fall Chinook salmon	SSC	SSC	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV late fall	Central Valley late fall Chinook salmon	SSC		Endangered - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
Herps				
Actinemys marmorata marmorata	Western Pond Turtle		SSC	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus boreas halophilus	California Toad			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	SSC	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	SSC	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	SSC	ARSSC
Taricha torosa	Coast Range Newt		SSC	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis fitchi	Valley Gartersnake			Not on any status lists
Thamnophis sirtalis sirtalis	Common Gartersnake			
Insects and Other Invertebrates				
Acentrella insignificans	A Mayfly			

Acentrella spp.	Acentrella spp.			
Anax junius	Common Green Darner			
Argia agrioides	California Dancer			
Argia emma	Emma's Dancer			
Argia nahuana	Aztec Dancer			
Argia spp.	Argia spp.			
Baetidae fam.	Baetidae fam.			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Brillia spp.	Brillia spp.			
Chironomidae fam.	Chironomidae fam.			
Cordulegaster dorsalis	Pacific Spiketail			
Cricotopus spp.	Cricotopus spp.			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Enallagma cyathigerum				Not on any status lists
Epeorus spp.	Epeorus spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Erpetogomphus compositus	White-belted Ringtail			
Erythemis collocata	Western Pondhawk			
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon spp.	Fallceon spp.			
Glossosoma spp.	Glossosoma spp.			
Glossosomatidae fam.	Glossosomatidae fam.			
Heptageniidae fam.	Heptageniidae fam.			
Hetaerina americana	American Rubyspot			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Ischnura perparva	Western Forktail			
Lepidostoma baxea	A Caddisfly			
Lepidostoma spp.	Lepidostoma spp.			
Lestes congener	Spotted Spreadwing			

Libellula croceipennis	Neon Skimmer			
Libellula saturata	Flame Skimmer			
Limnophyes spp.	Limnophyes spp.			
Ochrotrichia burdicki	A Caddisfly			
Pachydiplax longipennis	Blue Dasher			
Pantala flavescens	Wandering Glider			
Pantala hymenaea	Spot-winged Glider			
Plathemis lydia	Common Whitetail			
Polypedilum spp.	Polypedilum spp.			
Protoptila spp.	Protoptila spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Serratella micheneri	A Mayfly			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Stylurus olivaceus	Olive Clubtail			
Telebasis salva	Desert Firetail			
Tramea lacerata	Black Saddlebags			
Tricorythodes spp.	Tricorythodes spp.			
Zoniagrion exclamationis	Exclamation Damsel			
Mammals				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
Mollusks				
Anodonta californiensis	California Floater		SSC	
Ferrissia spp.	Ferrissia spp.			
Gyraulus spp.	Gyraulus spp.			
Margaritifera falcata	Western Pearlshell		SSC	
Menetus spp.	Menetus spp.			
Physa spp.	Physa spp.			
Physella virgata	Protean Physa			CS
Pisidium spp.	Pisidium spp.			
Planorbella tenuis	Mexican Rams-horn			CS
Planorbella trivolvis	Marsh Rams-horn			CS

Pyrgulopsis stearnsiana	Yaqui Springsnail			T
Sphaeriidae fam.	Sphaeriidae fam.			
Plants				
Alnus rhombifolia	White Alder			
Alopecurus carolinianus	Tufted Foxtail			
Alopecurus saccatus	Pacific Foxtail			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Carex pellita	Woolly Sedge			
Castilleja campestris succulenta	Fleshy Owl's-clover	Threatened	Endangered	CRPR - 1B.2
Cephalanthus occidentalis	Common Buttonbush			
Chloropyron palmatum	NA	Endangered	SSC	CRPR - 1B.1
Cyperus acuminatus	Short-point Flatsedge			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus squarrosus	Awned Cyperus			
Downingia bella	Hoover's Downingia			
Downingia cuspidata	Toothed Calicoflower			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Elodea canadensis	Broad Waterweed			
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle		SSC	CRPR - 1B.2
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euphorbia hooveri	NA			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Hydrocotyle umbellata	Many-flower Marsh-pennywort			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			

Hypericum anagalloides	Tinker's-penny			
Juncus acuminatus	Sharp-fruit Rush			
Juncus xiphioides	Iris-leaf Rush			
Lasthenia ferrisiae	Ferris' Goldfields		SSC	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lilium pardalinum pardalinum	Leopard Lily			
Ludwigia palustris	Marsh Seedbox			
Ludwigia peploides peploides	Floating Water Primrose			Not on any status lists
Marsilea vestita vestita	Hairy Pepperwort			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Mimulus latidens	Broad-tooth Monkeyflower			
Mimulus pilosus	Snouted Monkey Flower			Not on any status lists
Mimulus tricolor	Tricolor Monkeyflower			
Myosurus minimus	Little Mouse Tail			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Orcuttia inaequalis	San Joaquin Valley Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Orcuttia pilosa	Hairy Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Persicaria hydropiperoides	Water Pepper			Not on any status lists
Persicaria lapathifolia	Common Knotweed			Not on any status lists
Persicaria punctata	Dotted Smartweed			Not on any status lists
Phalaris arundinacea	Reed Canarygrass			
Pilularia americana	Pillwort			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys distantiflorus	California Popcorn-flower			
Plagiobothrys undulatus	Coast Allocarya			Not on any status lists
Platanus racemosa	California Sycamore			
Pogogyne douglasii	Douglas' Pogogyne			
Potamogeton diversifolius	Water-thread Pondweed			
Potamogeton nodosus	Longleaf Pondweed			

Potamogeton pusillus pusillus	Slender Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Puccinellia simplex	Little Alkali Grass			
Rorippa palustris palustris	Bog Yellowcress			
Sagittaria sanfordii	Sanford's Arrowhead		SSC	CRPR - 1B.2
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Sequoia sempervirens	Coast Redwood			
Sidalcea calycosa calycosa	Annual Checker-mallow			
Tuctoria greenei	Green's Awnless Orcutt Grass	Endangered	Rare	CRPR - 1B.1
Wolffia columbiana	Columbian Watermeal			
Wolffia globosa	Asian Watermeal			

Notes:
ARSSC = At-Risk Species of Special Concern
BCC = Bird of Conservation Concern
BSSC = Bird Species of Special Concern
CRPR = California Rare Plant Rank
CS = Currently Stable
IUCN = International Union for Conservation of Nature
SSC = Species of Special Concern

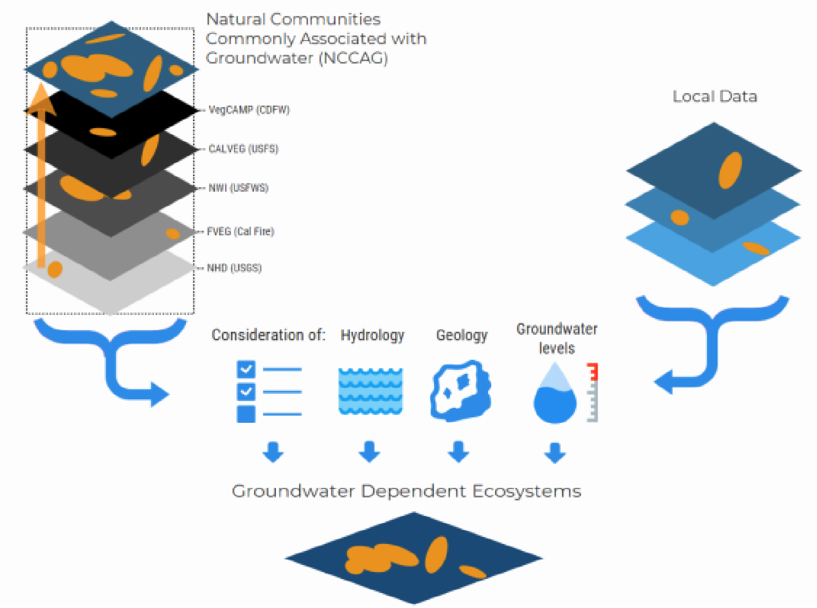
Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[6] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[7]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[6] *NC Dataset Online Viewer:* https://gis.water.ca.gov/app/NCDatasetViewer/

[7] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[8]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[9] on the Groundwater Resource Hub[10], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[8] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*
[9] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[10] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

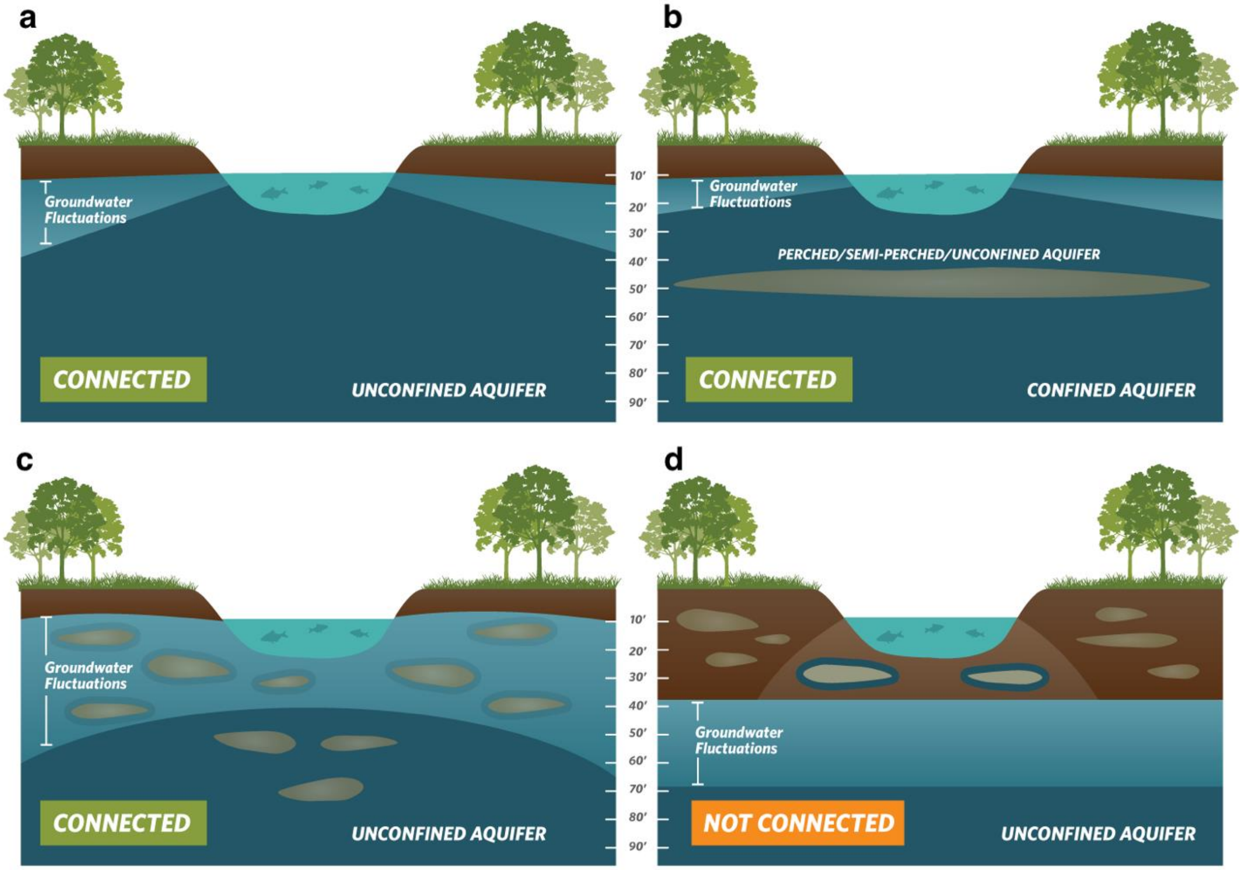

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[11] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[12] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[13] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[14]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

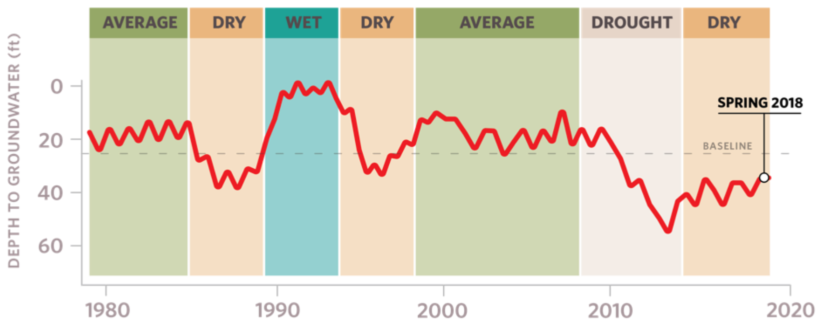

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[11] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[12] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[13] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[14] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[15], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

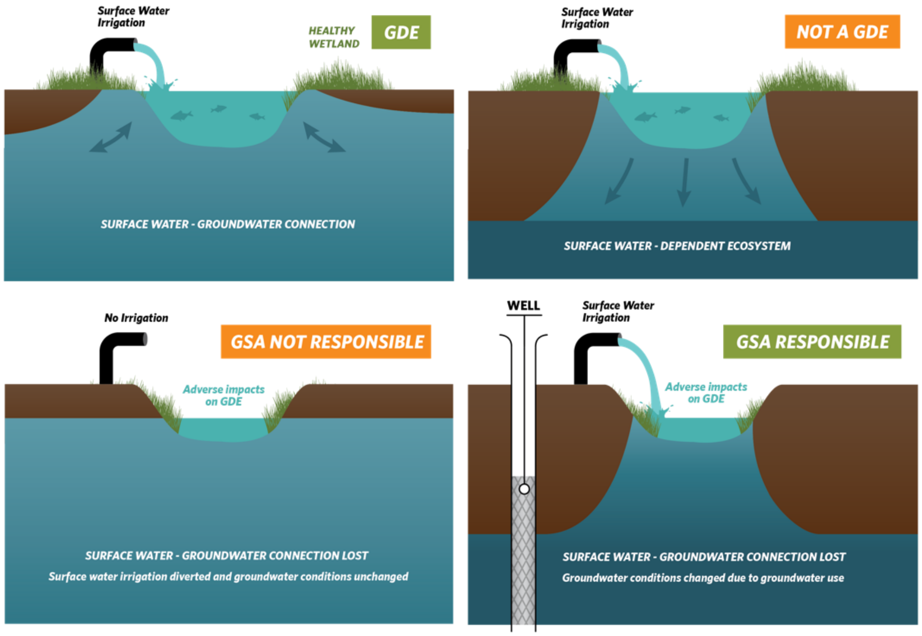

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[15] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

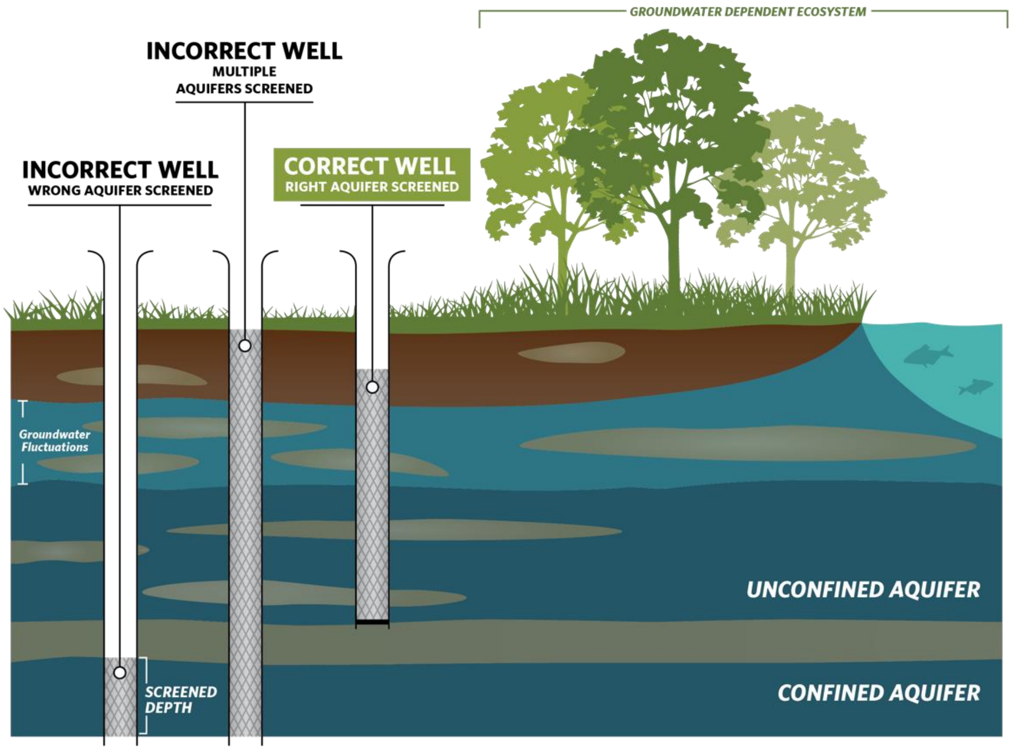

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[16] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

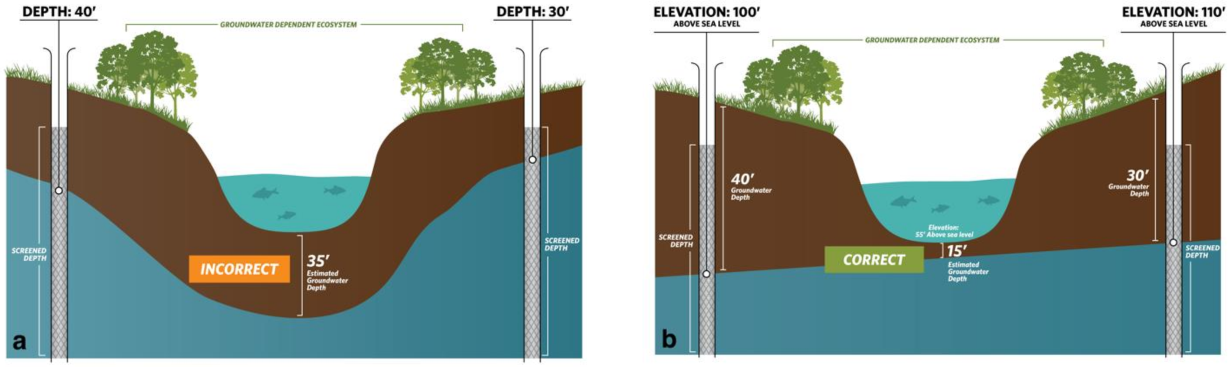

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

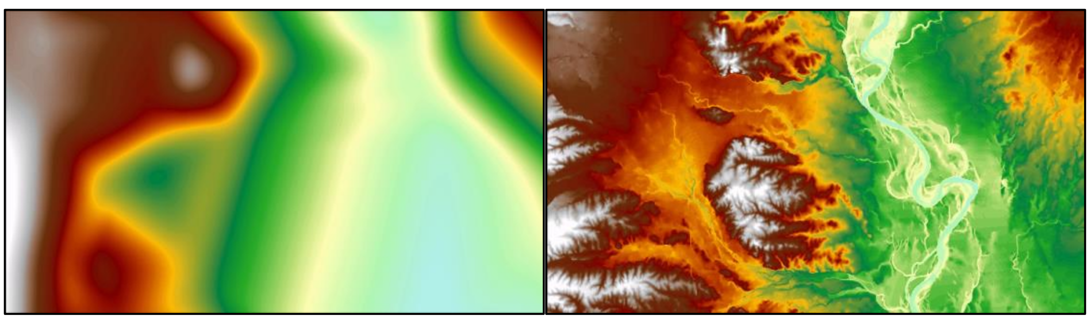

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[16] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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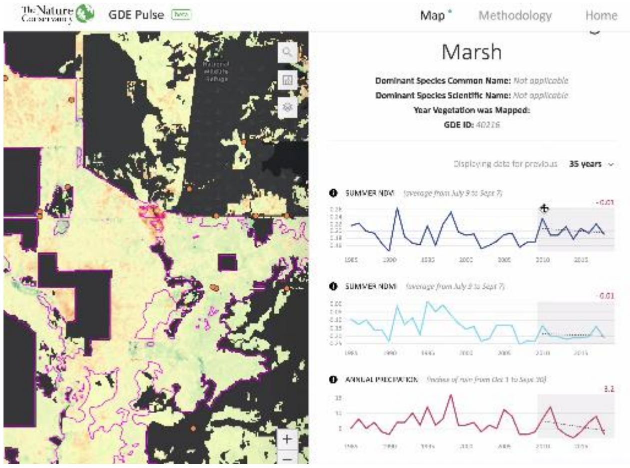
Visit https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[17]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[18]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

[17] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[18] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F

The GSA Response to TNC Comments on the Draft GSP is located on the DWR SGMA portal as Part 2 of 2 of TNC's Comments

Attachment G

Mapping Likely Interconnected Surface Water
The Nature Conservancy, California, May 2020

Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, ISW is defined as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:
The groundwater elevation data, available for Spring 2011-2012, and Spring and Fall 2013-2018, comes from the California Department of Water Resources (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). These data are represented as continuous raster layers that approximates "feet above or below mean sea level" based on groundwater well measurements. According to the documentation online, groundwater level measurements were selected based on measurement date and well construction information (where available) and are intended to approximate the groundwater levels in the unconfined to uppermost semi-confined aquifers. Each of the raster layer has a different extent, but all of them are limited to the Central Valley. To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

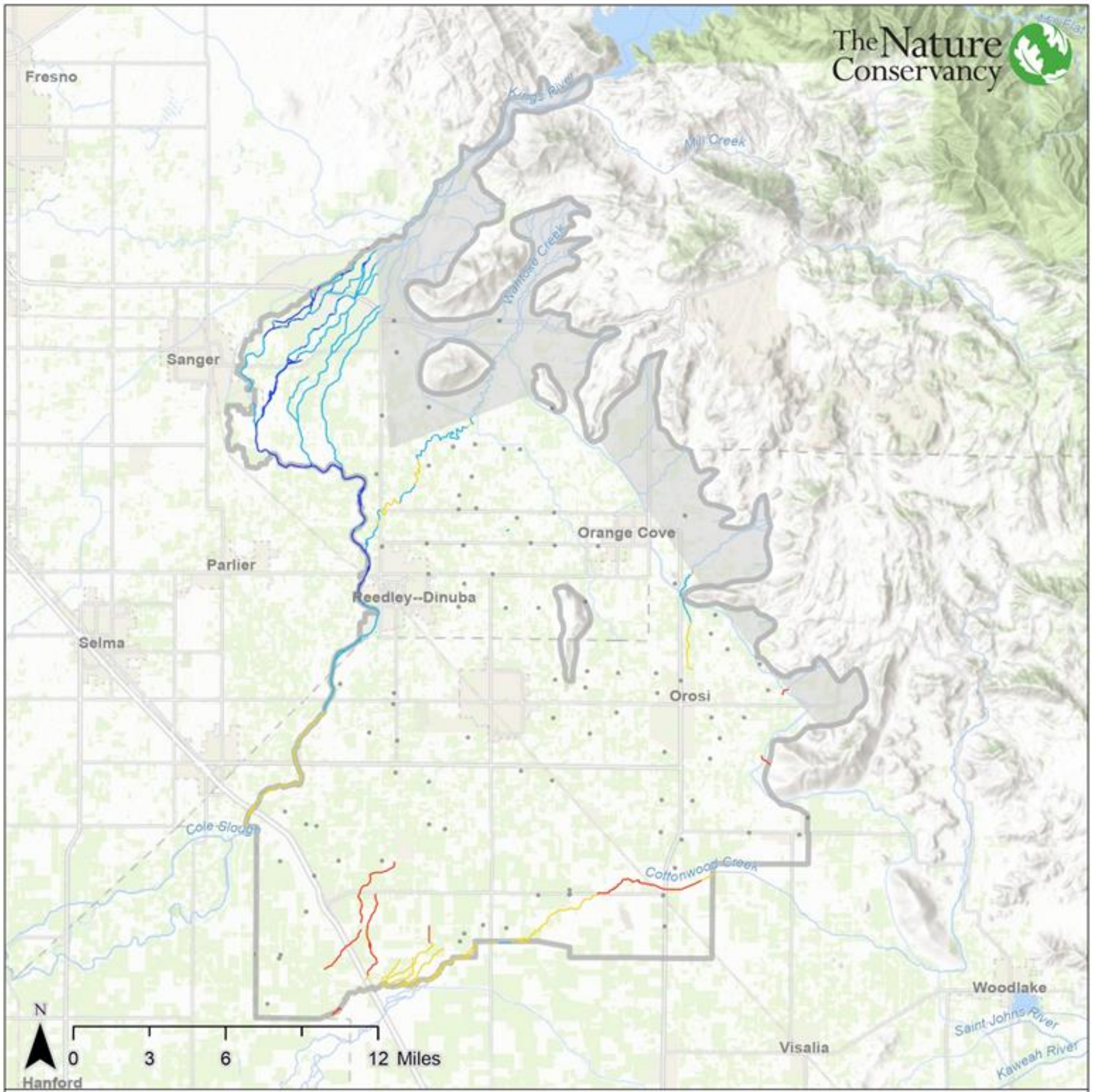
The map splits groundwater depth into four categories:

- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.
- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.

Interconnected Surface Water: Minimum Groundwater Depth (2011-2018)

Kings River East GSA GSP



Legend

- Groundwater Sustainability Agency (GSA)
- No groundwater depth data available
- Rivers and streams with no depth data (77.5 miles)
- Groundwater Elevation Monitoring Point

Minimum Groundwater Depth

- Connected - Gaining: Groundwater at or above stream surface (17.8 miles)
- Connected - Losing: Groundwater within 20 feet of stream surface (51.5 miles)
- Uncertain*: Groundwater within 20-50 feet of stream surface (28 miles)
- Likely Disconnected*: Groundwater greater than 50 feet below stream surface (13.4 miles)

**Streams could be connected to riparian or perched aquifers or shallow aquifers that are poorly characterized. More data are needed to confirm disconnected status.*

5-022.08_Kings_KingsRiverEast

Data Sources:
CA Dept. of Water Resources Groundwater Elevation Data, gis.water.ca.gov/app/gicima/
NHD Plus V2 Streams, nhdplus.com/NHDPlus/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[19]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[20]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[21] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

[19] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[20] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[21] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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GroundwaterResourceHub.org

June 3, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Lower Tule River Irrigation District Groundwater Sustainability Plan (GSP)

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Lower Tule River Irrigation District Groundwater Sustainability Agency's (GSA's) Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing *sustainable* groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be incomplete in addressing environmental beneficial uses and users. While the GSP addressed environmental beneficial users in some respects, our review finds that portions of the GSP should be remedied before being approved. Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address gaps within 180 days. In these cases, we strongly recommend that the Department set clear expectations that these be corrected in the 2025 plan update, and to the degree that gaps are due to lack of data, that these data gaps be addressed to inform the 2025 update.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides the GSA's response to TNC's comments on the Draft GSP.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We are disappointed to see the feedback that we provided on the draft GSP has been ignored in the final plan, as none of the 27 comments were adequately addressed in the Final GSP. This indicates poor engagement of environmental beneficial users, which undermines the intent of SGMA to ensure that sustainability be defined locally with the participation of all users. Based on our experience the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan" (23 CCR §355.4(b)(10)).

TNC recommendation: We strongly recommend that the GSA prioritize stakeholder engagement through improvements to their stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters (ISWs) – The GSP excluded potential and/or actual ISWs because the plan did not employ the best available science. The GSP simply states that "*there is no indication of interconnected surface water systems within the Tule Subbasin*" while no monitoring data, analysis, or other information is provided to support this conclusion. The GSP also lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)).

TNC recommendation: Until a disconnection can be proven, TNC recommends that the GSP include all potential and confirmed ISWs. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 952 acres of potential GDEs occur in the GSA boundary. TNC developed the Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

The plan does not adequately identify, map and consider GDEs. We believe that this does not meet plan evaluation criteria (1), (4) and (10), as defined in the 23 CCR §355.4(b). In addition, the Plan does not satisfy the requirement to identify GDEs (23 CCR §Section 354.16(g)) and consider beneficial users throughout the plan. Our review found that NC Dataset polygons were improperly removed from the GDE map based on the following:

- GDEs were rejected on the basis that groundwater levels were greater than 30 feet at a single point in time. This is a technically incorrect approach since groundwater levels fluctuate over

[1] Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

seasonal and interannual time scales due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Justifying the removal of NC dataset polygons solely based on this criterion does not acknowledge that groundwater levels temporally vary and the fact that many plant species within GDEs can access groundwater depths beyond 30-ft or have adapted water stress strategies to deal with intermittent periods of deep groundwater levels. Using this methodology disregards groundwater fluctuations and can leave many GDEs unprotected in the GSP.

TNC recommendation: We request that the GSA use groundwater levels that represent interannual and inter-seasonal variability and utilize additional information provided in Attachment D which provides best practices for using the NC Dataset to identify and consider GDEs throughout the GSP. Specifically, the GSA should use Digital Elevation Model (DEM) when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment D.

Water Budget – We were disappointed to see that the water budget did not include the current, historical and projected demands of native vegetation and/or managed wetlands, as required under SGMA (23 CCR §354.18(a) and (b)(3)). Evapotranspiration is included in the surface water budget as a surface water outflow, but groundwater outflow to ET should also be identified as a groundwater budget component. In addition, a single ET value lumps together crops as well as native vegetation. This is problematic because key environmental uses of groundwater are not specifically being accounted for as water supply decisions are made using this budget nor will they likely be considered in project and management actions.

TNC recommendation: As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

The Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. Potential ISWs and GDEs are located in areas where no shallow groundwater monitoring currently exists or is proposed, leaving data gaps unfilled. As a result, the monitoring network does not adequately characterize GDEs and other environmental beneficial users of surface water and groundwater.

TNC recommendation: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but *sustainable* groundwater management that considers the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Lower Tule River Irrigation District Groundwater Sustainability Plan

The complete LTRID GSA's GSP available at http://www.ltrid.org/sgma/#gsp for public review and comment, adopted on January 14 2020, was reviewed by TNC. We realize that the GSAs in the Subbasin have jointly prepared a comprehensive Monitoring Plan and Basin Setting, the *Tule Subbasin Monitoring Plan* and *Tule Subbasin Setting*, as Attachments 1 and 2 to the *Tule Subbasin Coordination Agreement* (Agreement and Attachments provided as Appendix A of the GSP). Responses to comments received on the Draft GSP are provided as Appendix C of the Final GSP. The comments and responses are also provided in Attachment F of this letter. This attachment lists our original comments on the complete Public Draft GSP, as submitted to the Tri-County Water Authority GSA during the public comment period, and states whether or not they were addressed in the Final GSP *[in green text in brackets]*. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

[Section 1.5.1 Beneficial Users (p. 1-39)]

- *[Our comment was not addressed. No changes to GSP text made.]* We appreciate that the GSP acknowledges that beneficial users include aquatic ecosystems associated with rivers and streams. This section could be improved by the identification of **various environmental uses and users of groundwater in the LTRID Plan Area, including: GDEs, interconnected surface waters (ISWs), managed wetlands, Protected Lands including conservation areas and other protected lands, and Public Trust Uses including wildlife (e.g., Pixley National Wildlife Refuge), aquatic habitat, fisheries and recreation, and please take particular note of the species with protected status.** The following resources can be used:
    - Natural Communities Commonly Associated with Groundwater dataset (NC Dataset) - https://gis.water.ca.gov/app/NCDatasetViewer/
    - The list of freshwater species located in the Tule Subbasin in Attachment C of this letter.
    - The California Department of Fish and Wildlife's California Natural Diversity Database (CNDDB).
    - The United States Fish and Wildlife Service's ECOS mapper for critical habitat designations - https://fws.maps.arcgis.com/home/webmap/viewer.html?webmap=9d8de5e265ad4fe09893cf75b8dbfb77

Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8)

[Section 1.4 LTRID GSA Plan Area (pp. 1-5 to 1-38)]

- *[No response was required.]* We appreciate that the GSP provides a description of the jurisdictional boundaries, existing land use designations, water use sectors and types, groundwater well density, and existing water use management and monitoring programs. Surface water quality monitoring is conducted in the Tule Basin Water Quality Coalition (TBWQC) area along three natural waterways including the Tule River, Deer Creek, White River, and in Porter Slough.

[Section 1.4.12 Land Use Plans (pp. 1-26 to 1-35)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* The GSP describes the *General Plan for Tulare County*, and local land use plans for the Tipton, Poplar-Cotton, and Woodville Communities, which are focused on land use and water resources and supply. The GSP states (p. 1-34) that the Tulare County water resources goal is to "*provide a sustainable, long-term supply of water resources to meet domestic, agricultural, industrial, and recreational needs*." This section could be improved by providing a discussion of General Plan goals and policies related to the protection and management of wetlands, aquatic resources and riparian vegetation that could be affected by groundwater withdrawals. **Please consider adding a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs, if applicable.**
- *[Minor changes to GSP text were made but did not adequately address the comment.]* This section could be further improved by also identifying Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin that may be associated with GDE or ISW habitats. **Please consider identifying relevant HCPs and NCCPs within the GSP area, and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.**

[Section 1.4.15 Summary of Well Permitting Process (pp. 1-35 to 1-36)]

- *[Our comment was not addressed. No changes to GSP text made.]* Section 1.4.15 references the Tulare County well permitting program, administered by the Tulare County Environmental Health Services Division, which issues permits to construct, reconstruct, and destroy water wells under the Tulare County Well Ordinance. **Please provide details of this program and discuss 1) its potential effects on aquifer systems 2) how future well permitting and well construction will be coordinated with the GSP to assure achievement of the Plan's sustainability goals, and 3) the well permitting process incorporates protection of GDEs and ISWs within the Subbasin.**

- *[Our comment was not addressed. No changes to GSP text made.]* The State Third Appellate District recently determined that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF v. SWRCB and

Siskiyou County, No. C083239). **Please include a discussion of the need for well permitting programs to comply with this requirement.**

Checklist Items 5 to 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 2.2.3 Bottom of Basin (p. 2-3)]

- *[Our comment was not addressed. No changes to GSP text made.]* Section 2.2.3 of the GSP and Section 2.1.4 of the *Tule Subbasin Setting* (Appendix A of the GSP) discuss the bottom of the Subbasin using two approaches: geochemical (e.g., TDS of 2,000 mg/L), and geologic (e.g., contact between the Tertiary sedimentary deposits and granitic bedrock). Defining the bottom of the basin based on geochemical or physical properties is a suitable approach for defining the base of freshwater; however, as noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions." Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom. This will prevent the possibility of extractors with wells deeper than the basin boundary (defined by the base of freshwater) from claiming exemption of SGMA due to their well residing outside the vertical extent of the basin boundary. The vertical extent of the plan area could be better described by characterizing groundwater well extractions from the deepest wells in relation to defining the basin bottom.

[Section 2.2.6 Principal Aquifer and Aquitards (pp. 2-5 to 2-7)]

- *[Our comment was not addressed. No changes to GSP text made.]* Section 2.2.6 (p. 2-5) and Section 2.1.7 of the *Tule Subbasin Setting* (Appendix A of the GSP), describe two principal aquifers: the upper and lower aquifers, which are separated by the Corcoran Clay. Section 2.2.6.5 (p. 2-7) describes the "*predominant beneficial uses of groundwater in the Subbasin as agricultural irrigation, with other beneficial uses including municipal water supply, private domestic water supply, and livestock washing and watering*." **Please describe the role of the principal aquifer(s) in supplying groundwater to all beneficial uses and users of groundwater (including environmental).**

- *[Our comment was not addressed. No changes to GSP text made.]* Although the characteristics and physical properties are well described in the *Tule Subbasin Setting* (Appendix A of the GSP), knowledge of the hydraulic interaction between the shallow and deep aquifer (refer to Section 2.1.8 of the *Tule Subbasin Setting*) is listed as one of the "*primary sources of uncertainty*" in the hydrogeologic conceptual model. However, later on the report states (p. 16, Section 2.2.1 in the *Tule Subbasin Setting*), that "*comparisons of hydrographs from wells perforated in the upper aquifer with wells perforated predominantly in the lower aquifer and in close proximity show that groundwater levels in the upper aquifer are higher than groundwater levels in the lower aquifer…. This indicates a downward hydraulic* *gradient and indicates that the upper aquifer is recharging the lower aquifer of the Tule Subbasin*." Since vertical groundwater gradients between the upper and lower aquifers and other data to describe the interaction between these aquifers are uncertain, this is considered a data gap and the *Tule Subbasin Monitoring Plan* (Appendix A of the GSP) provides a plan for installation of additional wells in both the upper and lower aquifers as well as nested wells. However, the plan does not specifically state that data collection from these new wells will be used to address data gaps regarding vertical groundwater gradients and the interaction between the upper and lower aquifers. **Since the interaction between aquifers and the potential extent of connectivity is fairly unknown, this section could be improved by adding additional information about the objectives of the proposed new wells in the *Tule Subbasin Monitoring Plan* and *Tule Subbasin Setting* and in appropriate sections of the GSP.**

[Section 2.2.1 Groundwater Occurrence and Flow (Appedix A, pp. 16)]

- *[Our comment was not addressed. No changes to GSP text made.]* Groundwater elevation contours (with respect to sea level) are shown for spring and fall 2017 (Figures 2-17 and 2-18) for the upper aquifer and for fall 2010 (Figure 2-19) for the lower aquifer. The presence or absence of shallow perched groundwater that may be in communication with GDEs and ISWs, particularly in the vicinity of the Tule River, North Tule River and various recharge ponds, is not discussed. **Please investigate whether there are any data for shallow or perched groundwater on which GDEs and ISWs may be reliant. If these data are not available, this should be identified as a data gap, and a plan for additional data collection to address the data gap should be provided in this GSP.**

[Sections 2.2.6.4 and 2.3.4 Groundwater Quality (p. 2-6, 2-9)]

- *[Our comment was not addressed. No changes to GSP text made.]* As described in Section 2.2.4 of the *Tule Subbasin Setting* (Appendix A of the GSP), the primary groundwater quality issues that could affect the beneficial uses of groundwater in the Subbasin are nitrate and pesticides. Water quality may affect GDEs and the species they support. **Please consider including data about water quality in the zones where GDEs are potentially present. If there are no data, then please recognize this as a data gap and state that additional data will be collected and analyzed.**

<u>Checklist Items 8 to 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)</u>

[Section 2.3.6 Interconnected Surface Water Systems (p. 2-10)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. ISWs can be either gaining or losing. The GSP states (p. 2-10) that "*there is no indication of interconnected surface water systems within the Tule Subbasin*." No monitoring data, analysis, or other information is provided to support this important conclusion, which suggests that this is a data gap. **Please provide data or analysis to support this statement; and identify data gaps (e.g., lack of shallow or nested/clustered monitoring wells or stream gages), reconcile them or provide a plan to address them as needed to improve identification of ISWs prior to disregarding them in the GSP.**

Checklist Items 11 to 15 – Identifying and Mapping GDEs (23 CCR §354.16)

[Sections 1.4.8.1 Potential Groundwater Dependent Ecosystems (p. 1-19) and 2.3.7 Groundwater Dependent Ecosystems (p. 2-10)]

- *[Our comment was not addressed. No changes to GSP text made.]* Section 1.4.8.1 and accompanying map (Figure 1-10) present an analysis that GDEs are shown to potentially occur along the natural reaches of the Tule River. We appreciate the use of this approach which was developed using the DWR NC Dataset Viewer Map application. It shows GDEs in a small area near the northern boundary of the LTRID Plan Area and in a larger area along the Tule River in the western portion of the Plan Area. However, in Section 2.3.7 (p. 2-10), the GSP does not acknowledge the potential GDEs, and states "*Groundwater Dependent Ecosystems are discussed in Chapter 2.2.8 [2.2.7] of the Tule Subbasin Setting, which provides justification for ecosystems within the Tule Subbasin to be identified as not groundwater dependent given that the average depth to groundwater relative to the root zone for groundwater dependent plants is well below those plants' roots systems*." In Section 2.2.7 of the *Tule Subbasin Setting* we appreciate the reference to the GDE database (www.groundwaterresourcehub.org) and the inclusion of Valley Oak root zones, which can reach a depth of approximately 25 feet. However, other phreatophytes, such as cottonwoods, can root to much deeper depths depending on the water table and presence of root restrictive layers. The depth to groundwater map shown (Figure 2-26) is based on water levels in January 2015, during the drought. We appreciate that the *Tule Subbasin Setting* does note (p. 19 of Appendix A) that there may be periods of time when the groundwater level is within 25 feet of the land surface in some areas of the Subbasin. The areas most likely to support groundwater-dependent ecosystems are along the Tule River in and upstream of Porterville, and in the upper reaches of Deer Creek and White River.
    - While depth to groundwater levels within 30 feet are generally accepted as being a proxy for deciding if polygons in the NC dataset are connected to groundwater, seasonal and interannual groundwater fluctuations in the groundwater regime must be taken into consideration. Utilizing groundwater data from one point in time (e.g., winter 2014 to 2015, during the height of the recent drought) can misrepresent groundwater levels near GDEs and whether groundwater is available to meet their water requirements, and result in adverse impacts to the GDEs. Based on a study we recently

submitted to *Frontiers in Environmental Science*, we've observed riparian forests along the Cosumnes River to experience a range in groundwater levels between 1.5 and 75 feet over seasonal and interannual timescales. Seasonal fluctuations in the regional water table can support perched groundwater near an intermittent river that seasonally runs dry due to such fluctuations. While truly perched groundwater itself cannot directly be managed due to its isolation in the vadose zone, the water table position within a continuous saturated zone connected to the upper regional aquifer can and should be monitored and managed. **Depth to groundwater contour maps should be included in the GSP for the uppermost shallow groundwater system, if present, in the vicinity of the Tule River.** We highly recommend using depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons to support determination whether they are groundwater dependent. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer**. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset seasonally and interannually, or to determine conclusively whether shallow groundwater is hydraulically connected to underlying aquifers, include those polygons in the GSP until data gaps are reconciled in the monitoring network, and include specific measures and time tables to address the data gaps.**

- **Please provide depth to groundwater contour maps and note the following best practices for doing so.**
  - Are the wells used for interpolating depth to groundwater sufficiently close (<5 km) to NC Dataset polygons to reflect local conditions relevant to ecosystems?
  - Are the wells used for interpolating depth to groundwater screened within the surficial unconfined aquifer and capable of measuring the true water table?
  - Is depth to groundwater contoured using groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape? This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide much more accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make. It is better to assume that water surface elevations are constant in between wells, and then calculate depth to groundwater using a DEM of the land surface to contour depth to groundwater.

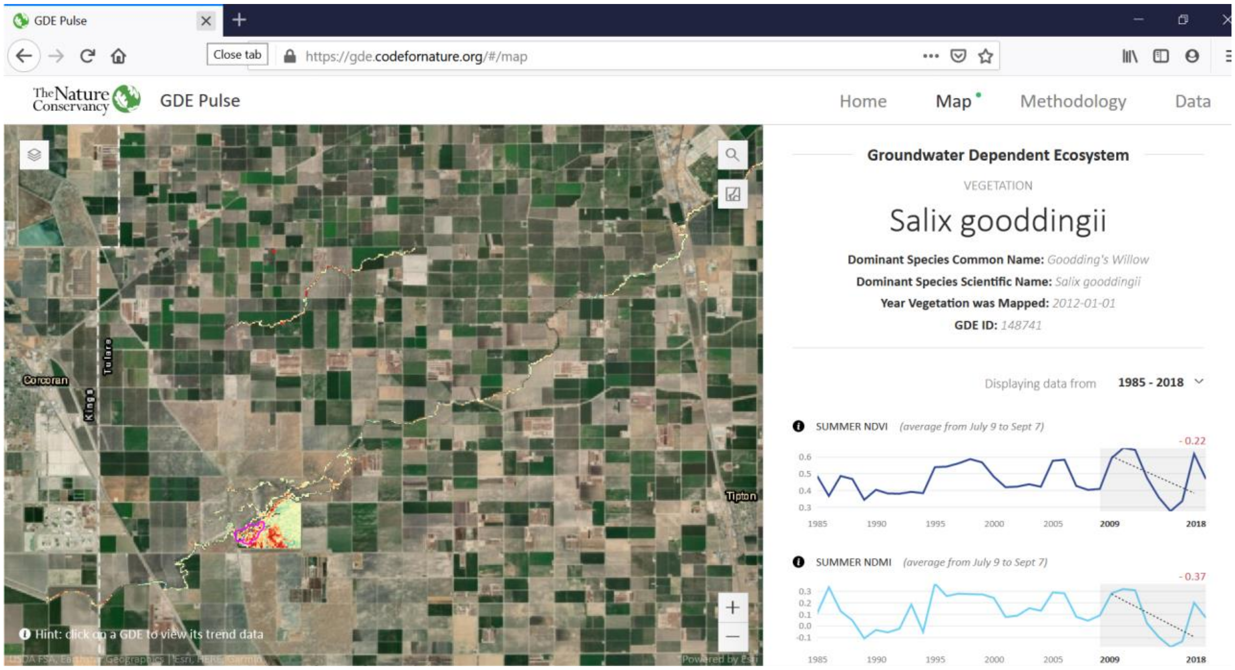
- There are not many existing wells completed in the upper aquifer (refer to Figure A1-2 in the *Tule Subbasin Monitoring Plan)* within the northern portion of the LTRID Plan Area in the vicinity of the Tule River and the mapped GDEs (Figure 1-10, Potentially Groundwater Dependent Ecosystems in the LTRID GSA Area). If there are insufficient groundwater level data in the upper aquifer and potential overlying shallow groundwater zones, then the NCCAGs in these areas should be included as potential GDEs in the GSP until data gaps are reconciled in the monitoring network. Confirmation of GDEs should be based on depth to groundwater in the shallow zone, or a correlation of groundwater depth and remote sensing data. **Please revise the GDE analysis in the GSP to include a complete analysis and identification of data gaps.**
- Groundwater requirements of GDEs vary with vegetation types and rooting depths. **Please indicate what vegetation is present in the potential GDEs, and whether the GDE was eliminated or retained based solely on the 30-foot depth limit.** While Valley Oak (*Quercus lobata*) have been observed to have a maximum rooting depth of ~24 feet rooting depths are likely to spatially vary based on the local hydrologic conditions available to the plant.

- *[Our comment was not addressed. No changes to GSP text made.]* In the scientific literature, it is generally acknowledged that GDEs can rely on groundwater for some or all of their requirements. GDEs can rely on multiple water sources simultaneously and at different temporal and / or spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow), and yet still require groundwater in order to remain viable and healthy. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface". The operative consideration in this definition is dependence, not exclusive dependence or continuous connection. Hence, we recommend using depth to groundwater contour maps derived from subtracting groundwater levels from a DEM, as described above, to identify whether a connection to groundwater exists for the GDEs presented in Figure 1-10. **Please refer to Attachments D and E of this letter for best practices for using local groundwater data to 1) verify whether polygons in the NC Dataset are supported by groundwater in an aquifer, and 2) verify whether ecosystem decline or recovery is correlated with groundwater levels.**

<u>Checklist Items 16 to 20, Describing GDEs (23 CCR §354.16)</u>

[Section 2.3.7 Groundwater Dependent Ecosystems (p. 2-10)]

- *[Our comment was not addressed. No changes to GSP text made.]* **Please provide information on the historical and current groundwater conditions near potential GDEs and / or the ecological conditions present during these times**. Refer to GDE Pulse (https://gde.codefornature.org; See Attachment E of this letter for more details) or any other locally available data remote sensing data (e.g., NDVI, leaf area index, evapotranspiration [ET] or other data) to describe depth to groundwater trends in and around GDE areas, and how they relate to trends in plant growth and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in the Subbasin.



- **Please consider an ecological inventory for potential GDEs (see Appendix III, Worksheet 2 of the GDE Guidance) that includes vegetation or habitat types that ranks the GDEs as having a high, moderate or low value.**

- **Please consider identifying whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat have been identified in or near any of the GDEs.** Resources for this include the list of freshwater species located in the Subbasin that can be found in Attachment C of this letter, the Critical Species Lookbook, USFWS' ECOS mapping tool, and CDFW's CNDDB database.

<u>Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)</u>

[Section 2.4 Water Budget (pp. 2-11 to 2-27)]

- *[Our comment was not addressed. No changes to GSP text made.]* ET is included in the surface water budget as a surface water outflow (Section 2.3.1.2 of the *Tule Subbasin Setting, Appendix A of LTRID GSP*) and is assumed to be the balance between total precipitation and areal recharge (p. 30 of Appendix A). The GSP (p. 30 of Appendix A) states that the ET "*value includes evapotranspiration from crops as well as native vegetation*" (ET value listed on Table 2-2b of Appendix A). However, crops and native vegetation are lumped together as a single ET value. Groundwater outflow to ET should also be identified as a groundwater budget component. If the outflow is not known, it should be identified as a data gap and provisional information should be provided until an analysis can be performed to address the data gap. **Please provide a breakdown of ET for riparian and other native vegetation (such as wetlands, marshes, phreatophytes and other communities). Identify any data gaps and outline the actions needed to address them and the schedule for their implementation.**

Checklist Item 23-26 Sustainability Goal (23 CCR §354.24)

[Section 3.2 Sustainability Goal (p. 3-1)]

- *[Our comment was not addressed. No changes to GSP text made.]* The Sustainability Goal of the Tule Subbasin GSAs is "*the absence of significant and unreasonable undesirable results associated with groundwater pumping, accomplished by 2040*." A further goal is that coordinated implementation of their respective GSPs "*will achieve sustainability in a manner that facilitates the highest degree of collective economic, societal, environmental, cultural, and communal welfare and provides all beneficial uses and users the ability to manage the groundwater resource at least cost*." **We appreciate the inclusion of environmental uses and users of groundwater in the Sustainability Goal. We suggest adding a reference to GDEs and ISWs, which may be present in the Subbasin (please see comments under Checklist Items 16-20) and are beneficial users of groundwater.**

- *[Our comment was not addressed. No changes to GSP text made.]* The GSP states that there is no connectivity between groundwater and the Tule River; however, there isn't quantitative analysis, monitoring data, or other information provided to support this finding. **Please include ISWs in the Sustainability Goal until sufficient data is available to conclude the status of ISWs.**

- *[Our comment was not addressed. No changes to GSP text made.]* GDEs are dependent, in part, on suitable water quality; however, the GSP only considers water quality for irrigation and domestic use. **Please include impacts from degraded water quality on the plant and wildlife communities within GDEs**.

Checklist Item 26 – Measurable Objectives (23 CCR §354.30)

[Section 3.5.1 Measurable Objectives and Interim Milestones (pp. 3-5 to 3-14)]

- *[Our comment was not addressed. No changes to GSP text made.]* Interim milestones and measurable objectives for the chronic lowering of groundwater levels, groundwater storage, and degraded groundwater quality sustainability indicators do not mention environmental users, such as GDEs and ISWs. For each of these applicable sustainable management criteria, **please include a discussion of ISWs and GDEs in this section and state whether the measurable objectives and interim milestones will help achieve the Sustainability Goal.**

- *[Our comment was not addressed. No changes to GSP text made.]* Section 3.4 (p. 3-3) states that the depletion of ISWs does not apply as a sustainability indicator, and therefore, "*cannot create adverse conditions that are significant and unreasonable*." No monitoring data, analysis, or other information is provided to support this important conclusion, which suggests that this is a data gap. **Please modify this section of the GSP to 1) develop measurable objectives for possible ISWs, including GDEs, and 2) include a statement that a data gap exists related to the interconnectedness of the Lower Tule River, White River and Deer Creek with shallow groundwater.**

<u>Checklist Item 27-29 – Minimum Thresholds (23 CCR §354.26c</u>)

[Section 3.5.2 Minimum Thresholds (pp. 3-14 to 3-20)]

- *[Our comment was not addressed. No changes to GSP text made.]* Similar to the discussion of measurable objectives and interim milestones, minimum thresholds for chronic groundwater level decline, storage depletion and groundwater quality do not consider GDEs, and minimum thresholds for depletion of ISWs are not developed. **Please include development of sustainable management criteria for GDEs and ISWs as discussed above.**

<u>Checklist Item 30-46 – Undesirable Results (23 CCR §354.26</u>)

[Section 3.4 Undesirable Results (p. 3-2)]

- *[Our comment was not addressed. No changes to GSP text made.]* Undesirable results are not described in the GSP. Section 3.4 refers readers to the *Tule Subbasin Setting Coordination Agreement* (Appendix A of the GSP). Undesirable results are not described in the coordination agreement either. The GSP (p. 3-3) states that there are four groundwater conditions with sustainability indicators that may have potential to cause significant and unreasonable effects within the Subbasin. These conditions are 1) chronic lowering of groundwater levels indicating a depletion of supply if continued over the planning and implementation horizon; 2) reduction of groundwater storage; 3) Degraded water quality, including the migration of contaminant plumes that impair groundwater supplies; and 4) land subsidence that substantially impacts critical infrastructure. The GSP states (p. 3-3) that "*…to groundwater conditions, the depletion of interconnected surface waters and seawater intrusion, do not apply as sustainability indicators within the Tule Subbasin, and therefore, cannot create adverse conditions that are significant and unreasonable*." However, no monitoring data, analysis, or other information is provided to support this important conclusion. **Please modify this section of the GSP to describe undesirable results for the four groundwater conditions with sustainability indicators addressed and add the depletion of ISW sustainability indicator. Please include a discussion of potential ISWs and GDEs.**

<u>Checklist Items 47-49 – Monitoring Network (23 CCR §354.34)</u>

[Chapter 4 Monitoring Network (p. 4-2)]

- *[Our comment was not addressed. No changes to GSP text made.]* As described in Section 4.1 (p. 4-2), the GSAs in the Subbasin have prepared a coordinated monitoring plan, the *Tule Subbasin Monitoring Plan*, provided as Attachment 1 to the Tule Subbasin Coordination Agreement (Appendix A of the GSP). The GSP summarizes the Subbasin monitoring network by referencing the *Tule Subbasin Monitoring Plan* and providing any additional information that directly relates to the LTRID GSA's monitoring network for each sustainability indicator. In the monitoring well design section, the GSP states (p. 4-3) that *"…the sustainability indicators of seawater intrusion and depletion of interconnected surface water are not applicable to the Tule Subbasin*." No monitoring data, analysis, or other information is provided to support this important conclusion, which suggests that this is a data gap. **Please provide data or analysis to document this statement.** As stated above in the comments for Checklist Items 8-20, **please reconcile data gaps (shallow monitoring wells, stream gages, and nested/clustered wells) in this section of the GSP to improve ISW characterization in future GSPs.**

- *[Our comment was not addressed. No changes to GSP text made.]* Representative monitoring (p. 4-6) accounts for the five management areas established in this plan (jurisdictional boundaries of the Lower Tule River Irrigation District, Tipton Community Service District, Woodville Public Utility District, Poplar Community Service District, and the County MOU area within Tulare County) and consists of 10 wells for monitoring groundwater levels (Table 4-1, p. 4-8) and six wells for monitoring groundwater quality (Table 4-2, p. 4-10). To address the groundwater level data gaps, new monitoring well locations have been identified for monitoring the individual aquifers in the Subbasin in areas where there are no existing wells, as described in Section 2.1.1.1 (p. 6) of the *Tule Subbasin Monitoring Plan* (Appendix A of the GSP). The plan states that the new wells, combined with existing monitoring wells, will improve the ability to develop representative upper aquifer groundwater contour maps and provide a better network of calibration targets for the Subbasin-wide groundwater model. A total of 12 new upper aquifer monitoring wells have been identified for possible inclusion in the plan as shown on Figure A1-2 of the *Tule Subbasin Monitoring Plan* (Appendix A of the GSP). Of these wells, four will be completed as stand-alone upper aquifer monitoring wells and eight will be completed as nested wells with separate casings perforated in the upper and lower aquifers. One proposed well (Well 4) is located in the vicinity of GDEs near the northern boundary of the LTRID Plan Area (Figure 1-10) (refer to comments above for Checklist Items 11-15). However, there are no proposed well locations near the larger GDE area along the Tule River in the western portion of the Plan Area. Since the upper aquifer is the groundwater that would most likely be connected to GDEs and ISWs, the network should include monitoring wells in this zone near the areas where GDEs have been mapped**. We suggest modifying the well network to monitor the shallow zone near GDEs and ISWs.**

Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)

[Chapter 5 Projects and Management Actions (pp. 5-1 to 5-30)]

- *[Minor changes to GSP text were made but did not adequately address the comment.]* Chapter 5 identifies many important projects including LTRID GSA groundwater accounting actions, existing water supply optimization projects, surface water development projects, managed aquifer recharge and banking projects, and agricultural land retirement projects). These projects generally benefit the groundwater elevations, groundwater storage, groundwater quality, and land subsidence sustainability indicators. Surface water development projects that increase the total volume of water dedicated toward groundwater recharge, and construction or expansion of recharge pond projects may have potential environmental benefits. It would be advantageous to demonstrate multi-benefit projects from a funding and prioritization perspective.
    - **For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.**
    - If ISWs will not be adequately protected by those listed, **please include and describe additional management actions and projects targeted for protecting ISWs and GDEs.**
    - The surface water development / storage projects, such as the Success Reservoir Enlargement Project (p. 5-14) and Expansion or Development of new Irrigation District Recharge Basins (p. 5-19), can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such facilities have been incorporated into local HCPs and NCCPs, more fully recognizing the value of the habitat that they provide and the species they support. **For projects that construct recharge ponds, please consider identifying if there is habitat value incorporated into the design and how the recharge ponds can be managed as multiple-benefit projects to benefit environmental users.** Grant and funding opportunities for SGMA-related work may be prioritized for multi-benefit projects that can address water quantity as well as provide environmental benefits. **Please include environmental benefits and multiple benefits as criteria for assessing project priorities.**
    - For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

Attachment C

Freshwater Species Located in the Tule Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Tule Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[2]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[3] as well as on TNC's science website[4].

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	BCC	SSC	BSSC - First priority, BLM
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		SSC	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya valisineria	Canvasback		SSC	
Botaurus lentiginosus	American Bittern			

[2] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[3] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[4] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		SSC	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus buccinator	Trumpeter Swan			
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	BCC	SSC	BSSC - Third priority
Dendrocygna bicolor	Fulvous Whistling-Duck		SSC	BSSC - First priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	BCC	Endangered	USFS
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	BCC	Endangered	USFS, BLM
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		SSC	BSSC - Third priority
Ixobrychus exilis hesperis	Western Least Bittern		SSC	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Pelecanus erythrorhynchos	American White Pelican		SSC	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Vireo bellii	Bell's Vireo			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		SSC	BSSC - Third priority
CRUSTACEANS				
Branchinecta lindahli	Versatile Fairy Shrimp			
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	SSC	IUCN - Vulnerable
Branchinecta mackini	Alkali Fairy Shrimp			
Hyalella azteca	An Amphipod			
Hyalella spp.	Hyalella spp.			
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		SSC	ARSSC, BLM, USFS
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	SSC	ARSSC, BLM
Taricha torosa	Coast Range Newt		SSC	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis sirtalis sirtalis	Common Gartersnake			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
INSECTS AND OTHERS				
Ambrysus amargosus	Ash Meadows Naucorid			
Ambrysus spp.	Ambrysus spp.			
Anax junius	Common Green Darner			
Argia agrioides	California Dancer			
Argia spp.	Argia spp.			
Baetis tricaudatus	A Mayfly			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Caenis bajaensis	A Mayfly			
Chironomidae fam.	Chironomidae fam.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corixidae fam.	Corixidae fam.			
Cricotopus annulator				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Dicrotendipes adnilus				Not on any status lists
Dicrotendipes spp.	Dicrotendipes spp.			
Enallagma civile	Familiar Bluet			
Eukiefferiella claripennis				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Hydropsyche alternans				Not on any status lists
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila ajax	A Caddisfly			
Hydroptila spp.	Hydroptila spp.			
Ischnura barberi	Desert Forktail			
Ischnura denticollis	Black-fronted Forktail			
Leucorrhinia glacialis	Crimson-ringed Whiteface			
Leucorrhinia spp.	Leucorrhinia spp.			
Micropsectra nigripila				Not on any status lists
Micropsectra spp.	Micropsectra spp.			
Nectopsyche dorsalis	A Caddisfly			
Nectopsyche spp.	Nectopsyche spp.			
Orthocladius appersoni				Not on any status lists

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Orthocladius spp.	Orthocladius spp.			
Pantala flavescens	Wandering Glider			
Pantala hymenaea	Spot-winged Glider			
Pentaneura inconspicua				Not on any status lists
Pentaneura spp.	Pentaneura spp.			
Phaenopsectra dyari				Not on any status lists
Phaenopsectra spp.	Phaenopsectra spp.			
Plathemis lydia	Common Whitetail			
Polypedilum albicorne				Not on any status lists
Polypedilum spp.	Polypedilum spp.			
Rheotanytarsus hamatus				Not on any status lists
Rheotanytarsus spp.	Rheotanytarsus spp.			
Sigara alternata				Not on any status lists
Sigara spp.	Sigara spp.			
Sperchon spp.	Sperchon spp.			
Sperchon stellata				Not on any status lists
Sympetrum corruptum	Variegated Meadowhawk			
Tanytarsus angulatus				Not on any status lists
Tanytarsus spp.	Tanytarsus spp.			
Telebasis salva	Desert Firetail			
Tramea lacerata	Black Saddlebags			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Helisoma spp.	Helisoma spp.			
Menetus opercularis	Button Sprite			CS
Menetus spp.	Menetus spp.			
Physa acuta	Pewter Physa			Not on any status lists
Physa spp.	Physa spp.			
Planorbella binneyi	Coarse Rams-horn			CS

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Planorbella spp.	Planorbella spp.			
PLANTS				
Alisma triviale	Northern Water-plantain			
Allium validum	Tall Swamp Onion			
Alnus rhombifolia	White Alder			
Alopecurus aequalis aequalis	Short-awn Foxtail			
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Ammannia robusta	Grand Redstem			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla filiculoides	NA			
Baccharis glutinosa	NA			Not on any status lists
Baccharis salicina				Not on any status lists
Bergia texana	Texas Bergia			
Bidens laevis	Smooth Bur-marigold			
Bistorta bistortoides				Not on any status lists
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Callitriche palustris	Vernal Water-starwort			
Carex alma	Sturdy Sedge			
Carex amplifolia	Bigleaf Sedge			
Carex densa	Dense Sedge			
Carex fissuricola	Cleft Sedge			
Carex integra	Smooth-beak Sedge			
Carex jonesii	Jones' Sedge			
Carex lasiocarpa	Slender Sedge		SSC	CRPR - 2B.3
Carex nebrascensis	Nebraska Sedge			
Carex nervina	Sierra Sedge			
Carex sartwelliana	Yosemite Sedge			
Carex senta	Western Rough Sedge			
Carex spectabilis	Northwestern Showy Sedge			
Carex utriculata	Beaked Sedge			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Carex vesicaria vesicaria	Inflated Sedge			
Castilleja miniata miniata	Greater Red Indian-paintbrush			
Castilleja minor minor	Alkali Indian-paintbrush			
Cephalanthus occidentalis	Common Buttonbush			
Cyperus acuminatus	Short-point Flatsedge			
Cyperus erythrorhizos	Red-root Flatsedge			
Datisca glomerata	Durango Root			
Downingia bella	Hoover's Downingia			
Eleocharis bella	Delicate Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis quinqueflora	Few-flower Spikerush			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Epilobium oregonense	Oregon Willow-herb			
Erigeron coulteri	Coulter's Fleabane			
Eriophorum crinigerum	Fringed Cotton-grass			
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euphorbia hooveri	NA			Not on any status lists
Galium trifidum	Small Bedstraw			
Gentiana calycosa	Explorer's Gentian			
Gentianella amarella acuta	Autumn Dwarf Gentian			
Gentianopsis holopetala	Sierra Gentian			
Gentianopsis simplex	One-flower Gentian			
Glyceria elata	Tall Mannagrass			
Helenium bigelovii	Bigelow's Sneezeweed			
Helenium puberulum	Rosilla			
Hosackia oblongifolia	NA			1.B.3
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Isoetes bolanderi	NA			
Juncus dubius	Mariposa Rush			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Juncus effusus effusus	NA			
Juncus effusus pacificus				
Juncus macrandrus	Long-anther Rush			
Juncus macrophyllus	Longleaf Rush			
Juncus mertensianus	Mertens' Rush			
Juncus xiphioides	Iris-leaf Rush			
Kyhosia bolanderi				Not on any status lists
Lasthenia ferrisiae	Ferris' Goldfields		SSC	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lepidium oxycarpum	Sharp-pod Pepper-grass			
Lilium kelleyanum	Kelley's Lily			
Limnanthes montana	Mountain Meadowfoam			
Ludwigia peploides peploides	NA			Not on any status lists
Lythrum californicum	California Loosestrife			
Marsilea vestita vestita	NA			Not on any status lists
Micranthes aprica				Not on any status lists
Micranthes odontoloma				Not on any status lists
Micranthes oregana	NA			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Myosurus minimus	NA			
Narthecium californicum	California Bog Asphodel			
Navarretia intertexta	Needleleaf Navarretia			
Oenanthe sarmentosa	Water-parsley			
Orcuttia inaequalis	San Joaquin Valley Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Oreostemma alpigenum andersonii	Anderson's Tundra Aster			
Orthilia secunda	One-side Wintergreen			
Oxypolis occidentalis	Western Cowbane			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Panicum acuminatum acuminatum				Not on any status lists
Panicum acuminatum lindheimeri				Not on any status lists
Paspalum distichum	Joint Paspalum			
Pedicularis attollens	NA			
Pedicularis groenlandica	NA			
Perideridia gairdneri gairdneri	Gairdner's Yampah		SSC	CRPR - 4.2
Perideridia parishii latifolia	Parish's Yampah			
Perideridia parishii parishii	Parish's Yampah		SSC	CRPR - 2B.2
Perideridia pringlei	Pringle's Yampah		SSC	CRPR - 4.3
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phacelia distans	NA			
Phalaris arundinacea	Reed Canarygrass			
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Platanthera sparsiflora sparsiflora	Canyon Bog Orchid			
Platanus racemosa	California Sycamore			
Pluchea odorata odorata	Scented Conyza			
Pogogyne douglasii	NA			
Porterella carnosula	Western Porterella			
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton nodosus	Longleaf Pondweed			
Primula jeffreyi				Not on any status lists

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Primula tetrandra	NA			Not on any status lists
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Puccinellia simplex	Little Alkali Grass			
Ranunculus alismifolius alismifolius	Water-plantain Buttercup			
Ranunculus hystriculus				Not on any status lists
Rhododendron columbianum				Not on any status lists
Rhododendron occidentale occidentale	Western Azalea			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rumex conglomeratus	NA			
Rumex salicifolius salicifolius	Willow Dock			
Rumex violascens	Violet Dock			
Sagina saginoides	Arctic Pearlwort			
Sagittaria longiloba	Longbarb Arrowhead			
Sagittaria montevidensis calycina				Not on any status lists
Salix drummondiana	Satiny Salix			
Salix eastwoodiae	Eastwood's Willow			
Salix exigua exigua	Narrowleaf Willow			
Salix exigua hindsiana				Not on any status lists
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix lemmonii	Lemmon's Willow			
Salix melanopsis	Dusky Willow			
Scirpus microcarpus	Small-fruit Bulrush			
Senecio triangularis	Arrow-leaf Groundsel			
Sidalcea calycosa calycosa	Annual Checker-mallow			
Sidalcea hirsuta	Hairy Checker-mallow			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Sidalcea ranunculacea	Marsh Checker-mallow			
Sisyrinchium elmeri	Elmer's Blue-eyed-grass			
Solidago elongata				Not on any status lists
Sparganium angustifolium	Narrowleaf Bur-reed			
Sphenosciadium capitellatum	Swamp Whiteheads			
Spiranthes romanzoffiana	Hooded Ladies'-tresses			
Stachys albens	White-stem Hedge-nettle			
Triglochin palustris	Slender Bog Arrow-grass		SSC	CRPR - 2B.3
Tuctoria greenei	Green's Awnless Orcutt Grass	Endangered	Rare	CRPR - 1B.1
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Vaccinium uliginosum occidentale				Not on any status lists
Veronica americana	American Speedwell			
Viola macloskeyi	NA			
FISHES				
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Lampetra hubbsi	Kern brook lamprey		SSC	Vulnerable - Moyle 2013, USFS
Lavinia exilicauda exilicauda	Sacramento hitch		SSC	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		SSC	Near-Threatened - Moyle 2013
Mylopharodon conocephalus	Hardhead		SSC	Near-Threatened - Moyle 2013, USFS
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013

Notes:
ARSSC = At-Risk Species of Special Concern
BCC = Bird of Conservation Concern

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
BSSC = Bird Species of Special Concern CRPR = California Rare Plant Rank IUCN = International Union for Conservation of Nature SSC = Species of Special Concern				

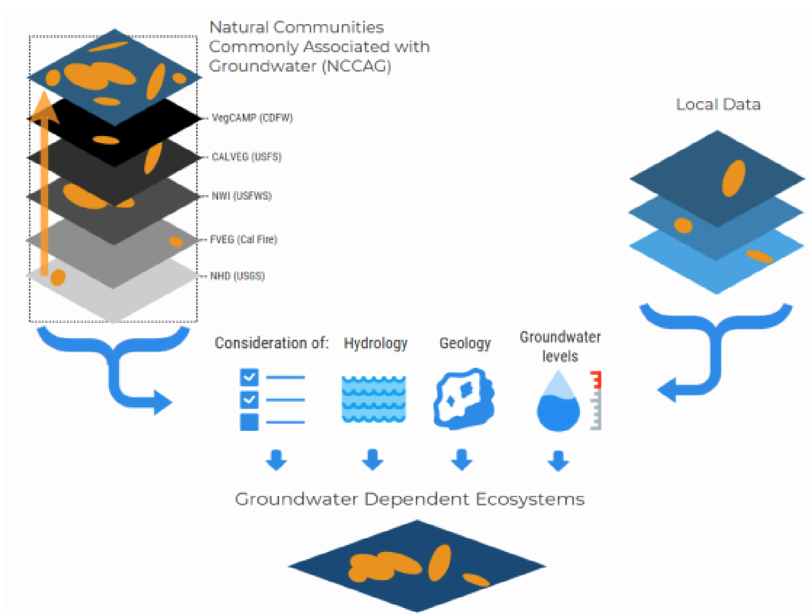
Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[5] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[6]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[5] *NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/*

[6] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[7]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[8] on the Groundwater Resource Hub[9], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[7] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[8] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[9] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

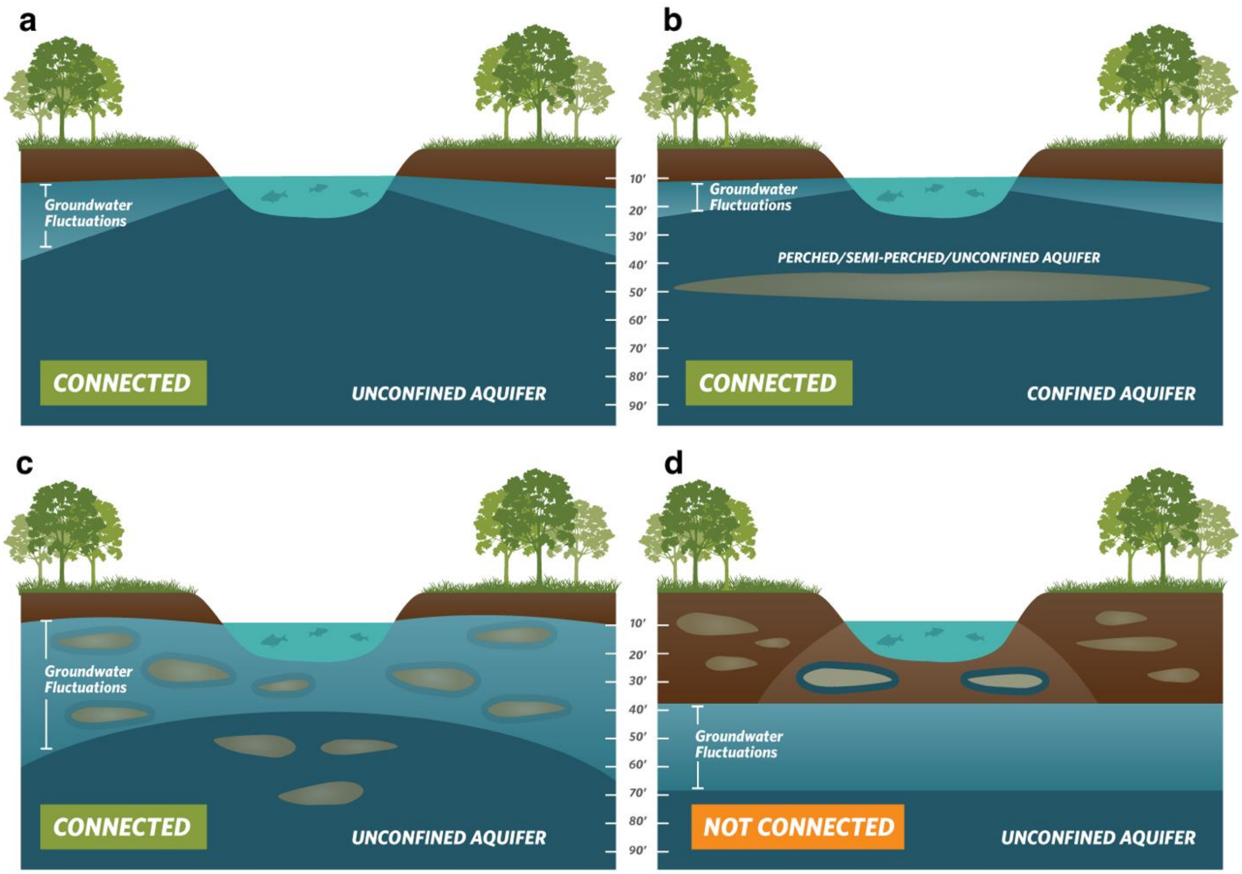

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[10] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[11] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[12] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[13]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network (see Best Practice #6).

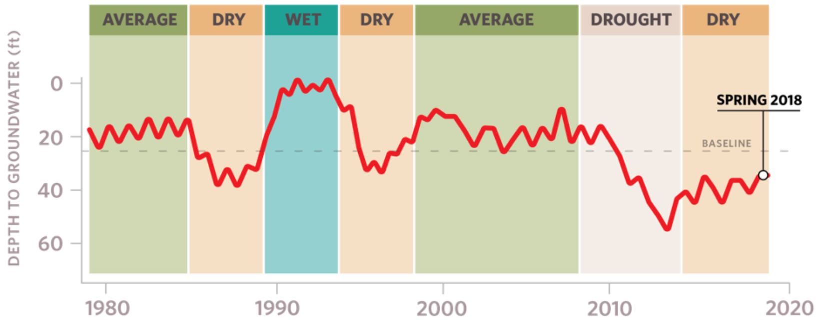

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[10] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[11] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[12] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[13] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[14], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

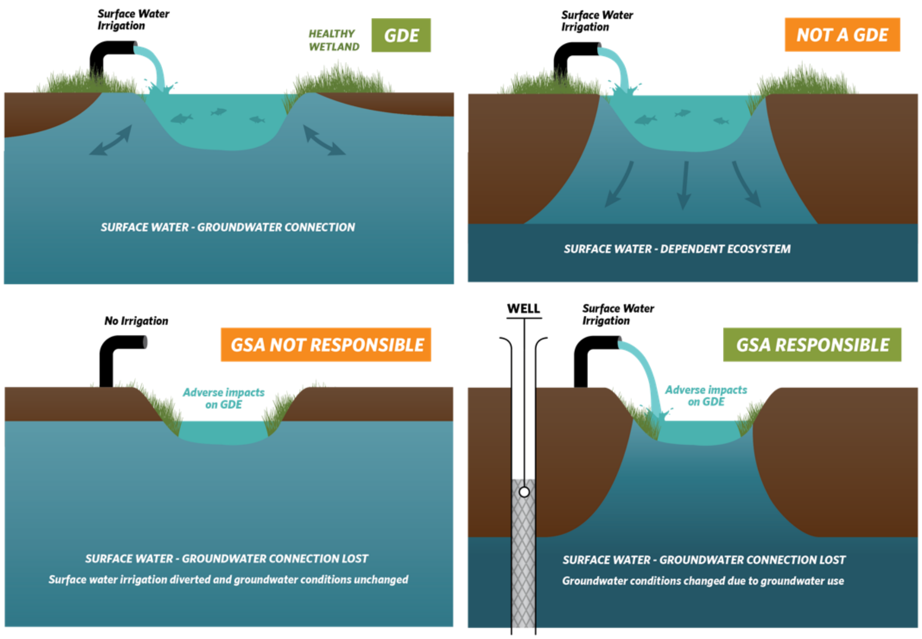

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[14] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

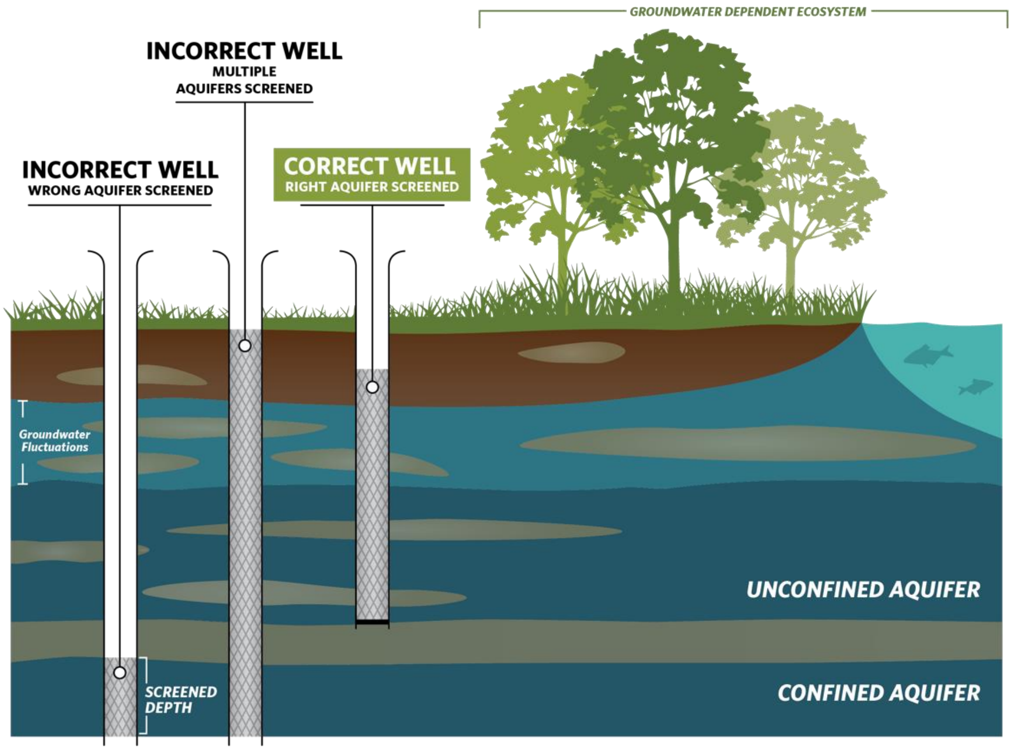


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[15] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

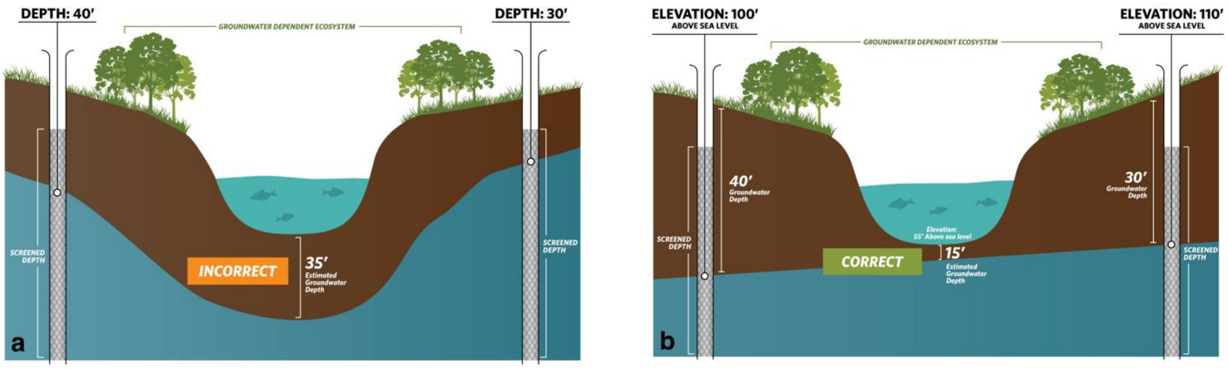


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

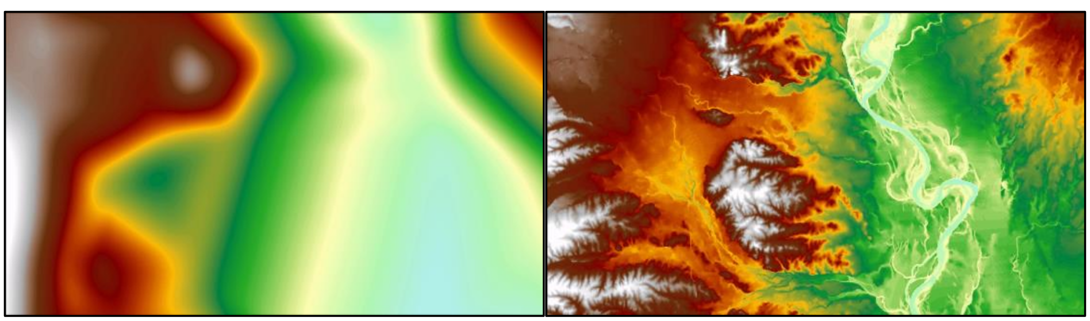


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[15] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

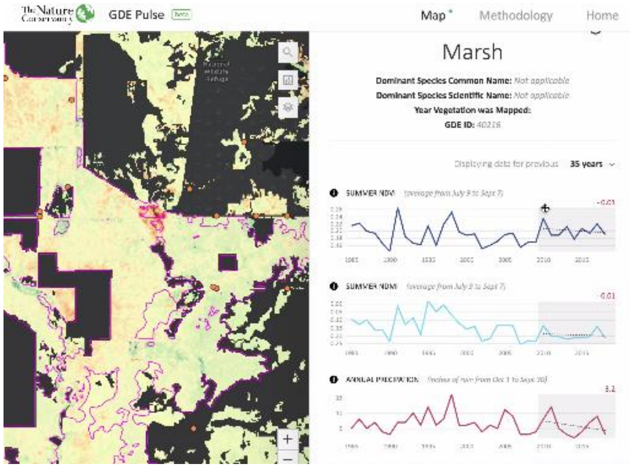
The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

Visit https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[16]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[17]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[16] *The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#*

[17] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F
GSA Response to TNC Comments on Draft GSP

MASTER RESPONSES TO COMMENTS RECIVED BY LOWER TULE RIVER IRRIGATION DISTRICT GSA (LTRIDGSA)

The following Master Responses have been prepared by staff for consideration by the Governing Board of the LTRIDGSA. The numbered responses correspond to the topics identified on the attached Table of Comments Received:

1. **<u>SUBSIDENCE/INFRASTRUCTURE IMPACTS</u>**
   a. **COMMENTORS:**
   Friant Water Authority, Arvin-Edison Water Storage District, Shafter-Wasco Irrigation District, United States Department of the Interior – Bureau of Reclamation, Lindsay-Strathmore Irrigation District.
   b. **COMMENT SUMMARY:**
   A number of comments were received on the topic of land subsidence and related impacts to infrastructure including the Friant Kern Canal (FKC), expressing concern that continued FKC subsidence will negatively impact other FKC users and was not adequately described in the GSP, and suggesting that the minimum thresholds for land subsidence established in the GSP should be set lower.
   c. **MASTER RESPONSE:**
   The undesirable results associated with subsidence that impacts major infrastructure such as the FKC is described in detail in the GSP itself, as well as in the Coordination Agreement between the GSAs in the Tule Subbasin, and in supporting technical reports. As has been shown in numerous studies, land subsidence is a gradual process that takes time to develop and time to halt.
   Subsidence impacts from groundwater pumping that have already occurred may continue for years. The minimum thresholds identified in the GSP, which were adopted in consultation with the other GSAs subject to the Tule Subbasin Coordination Agreement, must take into consideration future subsidence caused by groundwater pumping that has already occurred, along with proposed future actions. Based on existing information available to the GSA and information provided in the comment letters , the pumping by irrigators within the GSA has not been identified as the primary cause of the FKC subsidence, and much of the subsidence has occurred due to groundwater pumping outside the GSA boundaries. The GSP includes a number of actions to reduce undesirable results within the GSA's boundaries, but cannot control actions that occur outside GSA boundaries or reverse groundwater pumping that has already occurred. By reference to

the Coordination Agreement and the technical data related to that Agreement, the GSA believes that there has been adequate description of the subsidence issues related to critical infrastructure, including specifically the FKC.

Regarding the monitoring sites (RMS) and measureable objectives and minimum threshholds selected for the Subsidence Indicator, the GSA notes that subsidence impacts to critical infrastructure, including the FKC, are still in the process of being understood and quantified. At the same time the GSA acknowledges that site-specific monitoring locations as well as higher sensitivity minimum threshholds may be warranted in specific areas, which may in the future warrant consideration of establishment of management areas for these regions. The GSA governing board may consider additional language to address this concern be added to the GSP (See staff recommendations below.)

Regarding specific mitigation measures or payments for FKC repairs, the GSP identified, in general, that transitional pumping fees and penalties for excessive water usage would be used to mitigate impacts caused by groundwater pumping above the sustainable yield of the Tule Subbasin. As identified in the GSP, these fees will be adopted during the planning period. The GSA may consider adding additional provisions of the GSP to specify that it is likely that at least a portion of those fees will be used for mitigating impacts to critical infrastructure, and that the FKC is a likely focus of any contribution of fees for mitigation purposes (See staff recommendations below).

Several comments were received noting that the GSP's description of a transitional pumping plan to reduce groundwater pumping over time could potentially allow for pumping levels above current levels if each acre within the GSA utilized the full amount of transitional pumping. The GSP is identifying, in general terms, the transitional pumping plan that will be applied between 2020-2040, and the general description of the plan includes accounting for the pumping levels throughout the GSA and calling for a general reduction in use. Specific rules for the transitional pumping will be adopted under the GSP and these rules will be drafted to ensure that that overall pumping levels will not increase under transitional pumping. Transitional pumping is intended to allow for the reduction of groundwater pumping gradually; it is not intended to allow an increase in groundwater pumping.

d. STAFF RECOMMENDATIONS

Staff recommends that additional language could be added to the following sections of the GSP:

Recommendation 1.a. End of Section 3.5.1.4.2 (Measureable Objectives and Interim Milestones/Land Subsidence/Process for Determining Measurable Obectives and Interim Milestones):

"In response to concern about subsidence-related damage specifically to the Friant-Kern Canal ("FKC"), it has been suggested that monitoring sites and higher sensitivity Minimum Thresholds should be established for areas in close proximity to the FKC. In concept, the development of a defined FKC subsidence management area within the Tule Subbasin, with specific minimum thresholds and management actions for that management area, may be appropriate for some portions of the GSA. However, this is an action that the GSA Board, as well as the governing boards of other GSAs within the Tule Subbasin, will consider in the future as regionalized subsidence impacts are better understood through future monitoring and analysis."

Recommendation 1.b. End of Section 5.2.1. (Management Actions/Agency Groundwater Accounting Action):

"*The GSA recognizes that the Friant Kern Canal ("FKC") is among the most important critical infrastructure features that has been and will continue to be affected by subsidence. Along with the other GSA's in the Tule Subbasin, the LTRIDGSA has been part of the discussions on finding solutions to mitigate for future FKC subsidence. The relationship between groundwater use specifically within the GSA's planning area and subsidence of the FKC is still being studied and developed at the Subbasin level. As the FKC subsidence mitigation issues, and the relative impact of groundwater use as amongst the various regions of the Subbasin, become better defined, the GSA may consider adopting a specific policy that calls for the use of a reasonable portion of the transitional pumping fees, or other GSA related fees, for mitigation of future FKC subsidence. At this time, however, any mitigation program is too speculative to be defined specifically in the GSP. In concept, the development of a defined FKC subsidence management area within the Tule Subbasin, with specific minimum thresholds and management actions for that management area, is an action for future consideration by the GSA Board and by the governing boards of other GSAs within the Tule Subbasin."*

2. ENVIRONMENTAL/GROUNDWATER DEPENDENT ECOSYSTEMS

a. COMMENTORS:

Audubon California / Community Water Center / The Nature Conservancy (joint letter); California Department of Fish and Wildlife; The Nature Conservancy (individual letter)

b. SUMMARY OF COMMENTS:

Several commenters suggested that the GSP did not utilize statewide data sources for identifying Groundwater Dependent Ecosystems (GDEs), and requested the GSP provide additional information concerning GDEs.

c. MASTER RESPONSE:

The term Groundwater Dependent Ecosystems has been specifically defined at 23 CCR § 351(m) to mean "ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface." The report prepared by the Tule Subbasin GSAs, the Tule Subbasin Settings referenced in section 2.3.6 of the GSP and attached to and incorporated into the GSP, found no interconnected surface water systems in the Tule Subbasin. Based on the data collected as part of the Tule Subbasin Setting no areas of surface water were found that meet the above definition.

Section 2.3.7 of the GSP, again referencing the *Tule Subbasin Settings*, found no GDEs based on a review of the the CDWR Groundwater Dependent Ecosystems database and the applicable depth to groundwater maps, although noting that such systems may be found in upstream areas of surface water streams. There may be areas where GDEs could exist due to seasonal variations, water year types, or areas where the type of soil allows slow percolation of surface waters or a perched level of groundwater, but such areas have not yet been identified from available data sources. Based on existing studies, and the nature of the groundwater basin as being clearly detached from any surface water ecological assets, it is not likely that any GDEs meeting the statutory definition exist (as noted in section 1.4.8.1 of the GSP).

The GSA will continue to address any emerging data. As the planned monitoring network is implemented and additional monitoring stations are installed and additional data is collected, particularly in areas near surface water, this analysis will be updated as data is collected. The potential for short term connectivity due to variations in water year types during different seasons of the year or due to types of soil will be studied. If interconnected surface waters or GDEs are identified, then the GSP will be updated to reflect how the identified sustainable management criteria will impact these areas.

Until there has been any new information that establishes the likelihood of the existence of any GDEs within the GSA planning area, additional information concerning the identification of conservation areas and public trust lands, as suggested by the comments received, is not warranted. If the GSA learns of the existence of areas that meet the regulatory definition of GDEs, then it will consider the list of freshwater species provided by The Nature Conservancy, and determine the appropriate measurable objectives and minimum thresholds

d. STAFF RECOMMENDATIONS

Recommendation 2.a. Staff recommends that the GSA governing board consider adding all or a portion of the above response as additional text in the GSP at the end of Section 1.4.8.1 (GSA Plan Area/Communities Dependent on Groundwater/Potentially Groundwater Dependent Ecosystems).

3. BENEFICIAL USER IDENTIFICATION - PUBLIC WATER SYSTEMS/DOMESTIC WELLS

a. COMMENTORS:

AC-CWC-TNC, CWC, TC, WPUD

b. SUMMARY OF COMMENTS:

Commenters assert that the GSP does not adequately describe public drinking water systems or Disadvantaged Communties, does not identify domestic water users or domestic well identification and quality tracking data, and does not identify how an adequate groundwater supply will be ensured for public water systems and domestic water users or future growth of those systems.

c. MASTER RESPONSE:

Regarding the assertion that public drinking water systems have not been adequately identified or included in the planning process, these comments ignore the fact that the LTRIDGSA formed under cooperative agreements with the only public water systems and Disadvantaged Communtities that exist within the GSA's planning area, with the exception of Woodville Labor Camp, which is identified in the GSP as public water system. Accordingly, the public water systems and DACs have been specifically identified from the outset of the planning process, and the DAC representatives have participated in every aspect of the GSP review process from the outset of GSP development. These representatives have had the opportunity to suggest specific monitoring steps, measurable objective criteria and management actions, but did not in fact offer any.

As described in the GSP (in particular Section 1.4.3.2), the agreements with the PUD/CSDs within the GSA boundaries (copies of signed agreements attached to the draft GSP as Appendix 1-F provide extensive detail on how the GSA has engaged, and will continue to engage, with the PUD/CSDs under SGMA. Some of the specific provisions of these agreements include:

- PUD/CSDs agreed not to form a GSA over its jurisdictional boundaries of the GSA and agreed to be included within the boundaries of the GSA
- Sections 5-7 of the MOUs between the Special Districts and the GSA provide for various terms related to accounting for PUD/CSD water use,

and potential treatment of the PUD/CSD as a separate management area.

- Sections 9-10 of the MOUs provide the PUD/CSDs with various means for participation in the preparation of the GSP, which is intended to ensure that water supply planning for their areas is adequately provided for in the GSP.
- Section 11 of the MOUs provide the PUD/CSDs with the ability to withdraw from the Agreements and constitute their own GSAs, either individually or in combination with other agencies, a provision that is intended to protect the ability of the PUD/CSDs to manage its own groundwater supply planning in the event that any of them are not satisfied with the protections provided in the GSP prepared by the Irrigation District GSA.

These provisions will be implemented through the Groundwater Accounting system described in Section 5.2.1 of the GSP. Draft policies implementing this provision of the GSP have been drafted with input from the PUD/CSDs, and will be adopted following final adoption of the GSP. These policies essentially provide that the PUD/CSDs are able to operate according to historic averages without incurring any additional fees or costs, while providing a mechanism to allow for growth through the payment of fees for exceedance of historic pumping amounts. No additional or clarifying text to the GSP will is being recommended.

Regarding individual domestic connections, the GSA acknowledges that domestic well data represents a data gap that will be addressed moving forward, and is recommending additional GSP text to address this.

d. STAFF RECOMMENDATIONS

Recommendation 3.a. Staff recommends that the GSA governing board consider adding the following text to end of Section 3.5.1.3.1 (Measureable Objectives and Interim Milestones/Groundwater Quality/Process for Determining Measurable Obectives and Interim Milestones).

The GSA acknowledges a gap in data related to individual domestic well water locations, elevations and water quality. The GSA will address this gap in coordination with Tulare County, to the extent it is not addressed by other water quality monitoring programs that are being coordinated with this GSP. Although the GSA cannot assume responsibility for failure of individual wells, the GSA may consider additional management actions beyond those identified in Section 5 of this GSP if specific data is developed that identifies domestic wells that go dry due to the lowering of groundwater levels during plan implementation. Any such action should be in coordination with Tulare County, including the potential *for the continuation by the County of existing programs for drought mitigation assistance implemented during the last major drought.*

4. **WATER QUALITY - DISADVANTAGED COMMUNITIES (DACS)**
   a. **COMMENTORS:**
   Community Water Center
   b. **SUMMARY OF COMMENTS:**
   One commenter asserts that the GSP does not provide sufficient monitoring for water quality purposes, and does not establish sufficient measurable objectives and minimum thresholds related to groundwater quality that are specifically applicable to public drinking water systems and domestic water users. The commenter also asserted that the GSP does not provide sufficient protections against water quality problems that may be identified through existing or additional monitoring.
   c. **MASTER RESPONSE:**
   As a general proposition, the GSP recognizes the importance of protecting drinking water quality but also recognizes that water quality is already currently being addressed through a variety of programs and by numerous agencies with the authority and responsibility to specifically manage water quality. The GSA desires to coordinate with these agencies that have existing water quality regulations to avoid duplication of efforts and to utilize limited resources. To the extent the commenters suggest that greater water quality monitoring and protective actions should be provided for in the GSP, the GSA responds that such monitoring and protections, outside the context of existing water quality regulations and monitoring efforts, would be duplicative and outside the requirements that SGMA establishes for GSPs.

   Consistent with our agreements with existing identified DACs, the GSA has established broad water quality minimum thresholds and measurable objectives, utilizing existing water quality monitoring programs. As noted in the prior master comment response, the PUD/CSDs that are cooperating with the GSA in the development of this GSP had the opportunity to propose their own management area, with distinct minimum thresholds and measurable objectives, as the commenters have suggested. Specifically as noted in Section 1.4.3.2 of the GSP, the agreements with PUD/CSDs feature the following provisions:
   - PUD/CSDs have the opportunity to request a separate management area, with distinct minimum thresholds and measurable objectives to meet the sustainable management requirements. If they so elect, the PUD/CSDs will define the minimum thresholds and measurable objections that will apply within the PUD jurisdictional boundaries, in

conformance with state law.

- The PUD/CSDs agreed that if they do not elect to become a separate management area or if the proposed thresholds and objectives do not meet state legal requirements, then the GSA will prepare thresholds and measurable objectives needed to comply with state law and the PUD/CSDs will agree to implement them as necessary to meet the sustainable groundwater management requirements or until the PUD as a separate management area proposes thresholds and objectives that meet state requirements

None of the PUD/CSDs elected to propose a management area, nor have they proposed minimum thresholds or measurable objetives to be applied in their areas that are different or distinct from the remainder of the GSA planning area. The GSA will revisit this issue if and when the PUD/CSD representatives identify a need or desire for a separate management area, under the terms of the cooperative agreements. Staff will be recommending that these provisions be highlighted in the text of the GSP as a response to the comments received.

Regarding the comments suggesting that the GSA should be collecting data from the public water systems and individual domestic water users, the GSA has in fact been planning on collecting such data, and staff will recommend that additional text be added to the GSP to recognize this.

d. STAFF RECOMMENDATIONS

Recommendation 4.a. Staff recommends that the GSA governing board consider adding the following text to end of Section 3.5.1.3.1 (Measureable Objectives and Interim Milestones/Groundwater Quality/Process for Determining Measurable Obectives and Interim Milestones).

Under the terms of the cooperative agreements with the PUD/CSDs, those agencies have an ongoing opportunity propose minimum thresholds for additional constituents and determine whether additional changes to the monitoring network should be made to address water quality issues. The GSA will consider such proposals when made.

In addition, the GSA will seek to collect data from the public water systems as part of monitoring efforts. The collected data will reflect what these public water systems report to existing regulatory agencies to determine if existing regulatory requirements are being met and to determine if specific management actions would be warranted by the GSA under its authority to manage groundwater. The

GSA will be monitoring and coordinating these items to determine if groundwater pumping activities are contributing to undesirable effects related to degraded water quality.

5. **PUBLIC PARTICIPATION**
   a. **COMMENTORS:**
   Audubon California / Community Water Center / The Nature Conservancy (joint letter), Community Water Center (individual letter), Woodville Public Utility District
   b. **SUMMARY OF COMMENTS:**
   Commenters asserted that public comment was not sufficiently invited or that public noticing requirements were not met.
   c. **MASTER RESPONSE:**
   The GSA complied with all applicable statutory notice requirements in releasing the GSP. In addition, the GSA formed a Groundwater Planning Commission specifically for the purpose of expanding public participation. This step is not required by SGMA, and provides a higher degree of public participation than that provided by the majority of other GSAs.

   In addition, the GSP includes a detailed description of public meetings that were held in the planning process for the basin wide coordination agreement, which included all CSDs and PUDs in the current GSA service boundaries. As part of GSA formation, the irrigation district reached agreements with the CSD and PUD within its proposed boundaries to discuss rights and duties. The MOUs specified that the CSD and PUD could select their own representative to the Groundwater Planning Commission, the advisory board for the GSA. Notice of the Groundwater Planning Commission meetings and Irrigation District Board of Director meetings were sent to the CSDs and PUDs for distribution to their customers.

   All of the multitude meetings held over the past two years have been open to the public and conducted in a manner than encouraged public participation. Although many meetings may not have had a segmented portion of the meeting devoted to public comment, where no such segmented portion was provided, public comment was instead invited and encouraged throughout the entire meeting, and members of the public were never discouraged from offering comments. In fact, one of the commenters on this topic was a frequent public commenter during these unsegmented comment opportunities.

Staff will not be recommending any additional GSP text in response to these comments.

d. STAFF RECOMMENDATIONS

NA

6. <u>LAND USE (FUTURE GROWTH) – TULARE COUNTY/DACS</u>

a. COMMENTORS:

County of Tulare

b. SUMMARY OF COMMENTS:

The County of Tulare requested various clarifications regarding County and LAFCO authority over land use and growth issues related to or impacted by groundwater use and groundwater planning.

c. MASTER RESPONSE:

The comments received from the County of Tulare on the topic of land use and growth are clarifying in nature. Section 1.4.12.1 of the GSP adequately describes all of the updated plans. As land use in the identified communities is governed by Tulare County and is not directly addressed through the GSP, inclusion of a copy of these plans in the GSP is not necessary. Staff recommends clarifying language regarding individual domestic wells, consistent with changes recommended in response to other comments.

In addition, the GSA notes that the substantive land use and growth related issues involving public water systems and individual domestic water users will be addressed within the Groundwater Accounting System described in Section 5.2.1 of the GSP, and in the policies to be adopted in furtherance of that section, particularly policies related to accounting for municipal water agencies groundwater use and planning. See Master Responses 3 and 4 above.

d. STAFF RECOMMENDATIONS

Staff recommends adding the following text to the following GSP sections:

Recommendation 6.a. End of section 1.4.8.2 (GSA Plan Area/Communities Dependent Upon Groundwater/Groundwater Dependent Communities)

Groundwater dependent communities may also encompass individual domestic wells. Identification and monitoring of existing domestic water wells is difficult due to the lack of existing permitting and tracking information, and will be an item of future data development as part of GSP implementation.

7. **WATER BUDGETS/TECHNICAL ISSUES**

   a. **COMMENTORS:**
   Arvin-Edison Water Storage District/Shafter-Wasco Irrigation District (joint letter) Community Water Center (individual letter), County of Tulare, Hancock Farmland Services, Westchester Group Invesetment Management,

   b. **SUMMARY OF COMMENTS:**
   Commenters suggested or requested clarification and higher degree of specificity within the GSP regarding water budget conclusions, including sustainable yield determinations and landowner specific allocation methodologies.

   c. **MASTER RESPONSE:**
   Many of the details requested in these comments are provided in various analyses included in appendices, in particular the Tule Subbasin Coordination Agreement and the studies attached to that Agreement. Given the complexity of those attachments, the GSP itself was drafted in a manner to provide sufficient specificity while leaving the finer details to the appendices. Given that the information sought by the commenters can be found in the appendices, no changes to the GSP are recommended in response to these comments.

   To the extent the comments suggested that landowner-level allocation details be provided in the GSP, the GSA notes that these details are more appropriately determined in the specific policies to be adopted to implement the Groundwater Accounting System action item described in Section 5.2.1 of the GSP. These policies are presently in draft form, and are publicly available for review in advance of anticipated approval after January 2020. This action is sufficiently described in the GSP and no additional language is recommended by staff to address these comments.

   d. **STAFF RECOMMENDATIONS:**
   NA.

8. **GENERALIZED COMMENTS**

   a. **COMMENTORS:**
   Multiple

   b. **SUMMARY OF COMMENTS:**
   See attached Matrix

   c. **MASTER RESPONSE:**
   These comments are general in nature and as such are not susceptible to specific responses. These comments are noted in the attached matrix for informational purposes.

d. **STAFF RECOMMENDATIONS:**
NA.

9. **STAFF ADDITIONS/MODIFICATIONS**

9.1 - Clerical/Administrative/Non susbstantive

a. **Summary**

Various formatting, numbering, spelling, grammatical, organizational and other administrative corrections.

b. **Staff Recommendations**

Recommendation 9.a. 4 Creeks to provide

9.2 – No Authority or Intention to Affect Water Rights – Non-Waiver – Non-Admission

a. **Summary**

During development of the Coordination Agreeent, the collective GSAs within the Subbasin agreed to language for the Coordination Agreement to clarify that nothing in the water budgets, or the decisions as to how to calculate and divide the available Subbasin Sustainable Yield, should be construed as affecting any water rights of any landowner or any agency or entity that represents landowners (referred to in the Water Code, section 19, as a "Person"). Staff notes that this same intent should apply to the GSP, and to all conclusions and management actions called for under the GSP, and recommends that language similar to that included in the Coordination Agreement be added to the GSP.

b. **Staff Recommendations**

Recommendation 9.b. Add the following text to the end of section 1.3.3 (Introduction to GSP/Agency Information/Legal Authority):

It is noted that, consistent with § 10720.5(b) of SGMA, which provides that nothing in SGMA or in a plan adopted under SGMA determines or alters surface or groundwater rights under common law or any provision of law that determines or grants surface water rights, nothing in this Coordination Agreement is intended to modify the water rights of any Person (as that term is defined under Section 19 of the Water Code) . The GSA notes that it does not have the authority to modify any water rights through adoption of this GSP, nor does it intend that any in this GSP be construed as an admission by any Person (including without limitation the GSA, the Irrigation District or by any landowner or user of groundwater) regarding any subject matter of this GSP, including without limitation any water right or priority of any water right that is claimed by any Person. Nor shall this GSP in any way be construed to represent an admission by a Person with respect to the subject or sufficiency of another Person's claim to any water or water right or priority or defenses thereto, or to establish a standard for the purposes of the determining the respective liability of *any Person, except to the extent otherwise specified by law. Nothing in this GSP shall be construed as a waiver by any Person of its election to at any time assert a legal claim or argument as to water, water right or any subject matter of this GSP or defenses thereto. The division of Sustainable Yield among the GSA landowners under any Management Action adopted by this GSP does not constitute any determination that groundwater extractions by a landowner in excess of a budgeted amount would necessarily cause an undesirable result or that extractions less than a budgeted amount would necessarily not cause an undesirable result.*

The GSA intends, to the fullest extent permitted by law, to preserve the water rights of all Persons affected by this GSP as they may exist as of the adoption date of the GSP or at any time thereafter. The GSA further intends that any dispute or claim arising out of or in any way related to a water right alleged by a Person shall be separately resolved before an appropriate judicial, administrative or enforcement body with proper jurisdiction.

9.3 – Clarification of Per Acre Division of GSA Sustainable Yield

a. Summary

The GSP is based on the assumption that the Subbasin Sustainable Yield will be divided at both the Subbasin level (as amongst the GSAs) and the GSA level (as amongst landowners) on a per-acre basis. Though comments were received during the public review period on this top, through the public outreach process, it has been asserted that a more detailed and landowner-specific process, which includes assessment of individualized historic use data, needs to be completed in order to allocate available Sustainable Yield in a manner that is consistent with groundwater rights. The GSP does not make a determination of the validity of these assertions. Instead, the calculation of Sustainable Yield for the GSA's portion of the Tule Subbasin under this GSP has been developed with the understanding that the determinations being made are for purposes of meeting SGMA requirements, and expressly not for the purpose of determining relative groundwater rights of landowners. In particular, the Groundwater Accounting System, as described in section 5.2.1, is not intended to constitute a determination of water rights. This understanding is consistent with § 10720.5(b) of SGMA, which provides that nothing in SGMA or in a plan adopted under SGMA determines or alters surface or groundwater rights under common law. Any determination to divide the Sustainable Yield in any particular manner should not be deemed to conclusively determine the water rights of landowners.

Moreover, the GSA, like the other GSAs within the Tule Subbasin, consider that the per acrea basis of dividing GSA specific Sustainable Yield quantities represents the most readily-available and implementable manner of honoring correlative groundwater rights, because it is based on the well-documented conclusion that beneficial uses of the lands of the Tule Subbasin are, for the most part, uniformly agricultural in nature, and uniform in intensity of agricultural use. Furthermore, any individualized assessment that is based on historic use, even if it would be legally desirable or required in a legal process such as an adjudication, is not capable of being used due to the current state of data keeping for the thousands of individual landowners that exist within the entire Tule Subbasin. A decision to use historic use as at least one factor, therefore, would delay indefinitely the adoption any meaningful management plan under SGMA.

For these reasons, the per-acre division has been used for the purpose of the Groundwater Accounting System management action. At the same time, with the collection of additional data, refinements to the allocation or division methodologies will be considered in potential future updates, to and including the potential use of historic pumping data if such data is both available and is agreed to be used as the basis for any further refinement of allocation methodologies.

In order to clarify this issue and to acknowledge the potential future availability of alternative allocation or division methods, staff recommends adding language to the general description section for Management Action 5.2.1 (Agency Groundwater Accounting Action).

b. Staff Recommendations

Recommendation 9.c. Add the following to the end of Section 5.2.1 (Management Actions/Agency Groundwater Accounting Action/General Description):

As noted above, for purposes of creating a water budget pursuant to 23 Cal. Code Regs. §354.18, the GSAs in the Tule Subbasin have agreed that, for water budget accounting purposes, the Sustainable Yield for the Subbasin shall be divided amongst the GSAs for purposes of development of their GSPs as described in the attached water budget. The basin-wide portion of the Sustainable Yield identified in the water budget was divided amongst each GSA by multiplying that GSA's proportionate areal coverage of the Tule Subbasin times the total Subbasin Sustainable Yield.

In a similar manner, this Management Action (the creation of a Groundwater Accounting System) is intended to implement a division of the sustainable yield amongst affected landowners on the basis of a landowner's proportionate areal coverage of the GSA area times that portion of the Subbasin Sustainable Yield assigned to the GSA under the Coordination Agreement. This method of division of the GSA's portion of Subbasin Sustainable yield is consistent with Irrigation District law related to District water supplies in general.

The water budget to be divided amongst the GSA landowners under this Management Action is not an allocation or final determination of any water rights (including claimed appropriative or prescriptive rights). This understanding is consistent with § 10720.5(b) of SGMA, which provides that nothing in SGMA or in a plan adopted under SGMA determines or alters surface or groundwater rights under common law or any provision of law that determines or grants surface water rights. Rather, the use of the proportional acreage basis for dividing up the water budget for accounting purposes, will be used because it represents the most readily-available and implementable manner of accounting for the water budget for GSP purposes at this time, without the need for determining specific water rights, which would be controversial and time consuming and could not be completed in the time frames applicable to GSP development.

Similar to the Subbasin, the GSA will be collecting additional data and will consider refining or changing the method of dividing Sustainable Yield for internal GSA water budget purposes in future updates, including the potential use of historic pumping data if such data is both available and is agreed to be used as the basis for division.

9.4 – Clarification of Treatment of Imported Recharged Water

a. Summary

In informal discussions amongst GSAs in the Subbasin, some parties suggested that the GSPs should uniformly specify that any imported water that is used in groundwater recharge or banking projects, or for direct groundwater replenishment, should maintain its status as imported water, and therefore fully accounted for as an asset of the importing entity. The GSA agrees with this concept, and staff suggests wording be added to the GSP to clarify this.

b. Staff Recommendation

Recommendation 9.d. Add the following text to the end of Section 2.4.2.6 (Tule Basin Setting/Water Budget/Groundwater Budget/Sustainable Yield):

It should be noted that the GSAs have agreed, and this GSP assumes, that the exclusion of water imported by an entity from the calculation of Sustainable Yield of the Subbasin applies to imported water that is used for groundwater recharge or water banking purposes. The recharged or banked imported water retains its characterization as imported water even after it is used for recharge or banking purposes, and therefore is accounted for as being for the benefit of the importing entity, and not an addition to Sustainable Yield.

The Nature Conservancy
Protecting nature. Preserving life.

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GroundwaterResourceHub.org

May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: McMullin Area Groundwater Sustainability Plan (GSP), Kings Subbasin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the McMullin Area Groundwater Sustainability Agency's (GSA's) McMullin Area Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing sustainable groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be insufficient in addressing environmental beneficial uses and users.

The identification of environmental beneficial users, as well as their consideration when establishing the sustainability goal, undesirable results and minimum thresholds were insufficient (23 CCR §355.4(b)(4)) and lacked best available science (23 CCR §355.4(b)(1)). In the face of existing, severe overdraft, the GSP would allow groundwater management to largely ignore potential impacts to environmental beneficial users. This could result in irreparable harm to these beneficial users, undermining the intent of SGMA to achieve sustainability.

Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address within 180 days. In these cases, we strongly recommend that the Department, at a minimum, set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update. Should the treatment of environmental beneficial users be indicative of the quality of the overall plan, then we recommend the Department deem the plan inadequate.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides the GSA's response to TNC's comments on the Draft GSP. Attachment G provides a map and method summary of potential ISWs.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We are disappointed to see the feedback that we provided on the draft GSP has been ignored in the final plan, as only 1 out of 54 of our comments were adequately addressed in the Final GSP. This indicates poor engagement of environmental beneficial users, which undermines the intent of SGMA to ensure that sustainability be defined locally with the participation of all users. Based on our experience the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan" (23 CCR §355.4(b)(10)).

TNC recommendation: We strongly recommend that DWR require the GSA to prioritize stakeholder engagement through improvements to their stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters (ISWs) – The GSP incorrectly excluded potential and/or actual ISWs because the plan did not employ the best available science. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). ISWs were excluded based on lack of continuous saturation between surface water and groundwater. This justification of automatic removal is incorrect and inconsistent with the definition of ISWs. The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. Therefore, potential ISWs are not being managed in the GSP.

Map and Assessment of potential ISWs:
By combining multiple years and seasons of groundwater depth data, The Nature Conservancy has determined that within the McMullin Area GSP, 5.5 river miles have an uncertain connection to groundwater. Attachment G contains a one-page method summary and a GSP-specific map of ISWs. The interconnected surface water displayed on the map is based on the minimum groundwater depth estimated by the California Department of Water Resources between 2011 and 2018.

Note: In most cases, the groundwater depth data used to generate the ISW map does not include perched aquifers. As such, some streams marked as disconnected could in actuality, be connected.

TNC recommendation: Until a disconnection can be proven, TNC recommends that the GSP include all potential and confirmed ISWs. We recommend that the GSA conduct a thorough analysis of existing data on surface water-groundwater interconnectivity and estimate the quantity and timing of streamflow depletions in the subbasin. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 740 acres of potential GDEs occur in the GSA boundary. TNC developed the *Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs*[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

The plan does not to adequately identify, map and consider GDEs. We believe that this does not meet plan evaluation criteria (1), (4) and (10), as defined in the 23 CCR §355.4(b). In addition, the Plan does not satisfy the requirement to identify GDEs (23 CCR §Section 354.16(g)) and consider beneficial users throughout the plan. Our review found that NC Dataset polygons were improperly removed from the GDE map based on groundwater levels that were greater than 30-ft at a single point in time. This is a technically incorrect approach since groundwater levels fluctuate over seasonal and interannual time scales due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Justifying the removal of NC dataset polygons solely based on this criterion does not acknowledge that groundwater levels temporally vary and the fact that many plant species within GDEs can access groundwater depths beyond 30-ft or have adapted water stress strategies to deal with intermittent periods of deep groundwater levels. Using this methodology disregards groundwater fluctuations and may result in the omission of ecosystems that are groundwater dependent.

TNC recommendation: TNC recommends that the GSA utilize groundwater levels that represent interannual and inter-seasonal variability along with additional information provided in Attachment D which provides best practices for using the NC dataset to identify and consider GDEs throughout the GSP. Specifically, the GSA should use a Digital Elevation Model (DEM) when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment D.

Water Budget – We were disappointed to see that the water budget did not include the current, historical and projected demands of native vegetation and managed wetlands, as required under SGMA (23 CCR §354.18(a) and (b)(3)). The GSP only focused on a subset of water use sectors, including urban and agricultural users of groundwater. This is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget nor will they likely be considered in project and management actions.

[1] *Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf*

TNC recommendation: As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. As a result, the monitoring network does not adequately characterize GDEs and other environmental beneficial users of surface water and groundwater. Potential GDEs are located along surface water bodies where no shallow groundwater monitoring is proposed. Potential ISWs have been dismissed in the GSP, without proposed recommendations to improve ISW identification, mapping, and estimates of depletions. Therefore, GDEs and ISWs are not being specifically addressed by the monitoring network in the GSP.

TNC recommendation: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess potential impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but sustainable groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

<table>
<tr><th colspan="2">GSP Plan Element*</th><th>GDE Inclusion in GSPs: Identification and Consideration Elements</th><th>Check Box</th></tr>
<tr><td>Admin Info</td><td>2.1.5 Notice & Communication
23 CCR §354.10</td><td>Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.</td><td>1</td></tr>
<tr><td rowspan="3">Planning Framework</td><td rowspan="3">2.1.2 to 2.1.4 Description of Plan Area
23 CCR §354.8</td><td>Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.</td><td>2</td></tr>
<tr><td>Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.</td><td>3</td></tr>
<tr><td>Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs</td><td>4</td></tr>
<tr><td rowspan="7">Basin Setting</td><td rowspan="3">2.2.1 Hydrogeologic Conceptual Model
23 CCR §354.14</td><td>Basin Bottom Boundary:
Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?</td><td>5</td></tr>
<tr><td>Principal aquifers and aquitards:
Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?</td><td>6</td></tr>
<tr><td>Basin cross sections:
Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?</td><td>7</td></tr>
<tr><td rowspan="4">2.2.2 Current & Historical Groundwater Conditions
23 CCR §354.16</td><td>Interconnected surface waters:</td><td>8</td></tr>
<tr><td>Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).</td><td>9</td></tr>
<tr><td>Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.</td><td>10</td></tr>
<tr><td>Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).</td><td>11</td></tr>
</table>

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the McMullin Area Groundwater Sustainability Plan

The McMullin Area Groundwater Sustainability Plan (GSP) adopted November 6, 2019 was reviewed by TNC. Public draft GSP comments and responses, provided as Appendix 2C of the GSP, were reviewed and are referred to below. The TNC comments and responses are also provided in Attachment F of this letter. This attachment lists our original comments on the complete public draft GSP as submitted to the GSA during the public comment period, and states whether or not they were addressed in the final GSP [as green text within brackets]. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

[Section 2.5.1 Description of Beneficial Uses and Users (p. 2-37)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* There are state-owned lands in the McMullin Area, the Alkali Sink Ecological Reserve and the Kerman Ecological Reserve, both owned and managed by CDFW. CDFW was invited to participate in the McMullin GSP as an Interested Party, but no other groups were listed as environmental users of groundwater. **Please identify whether or not the following beneficial uses and users of groundwater in the Subbasin are present: Protected Lands, including refuges, conservation areas, and recreational areas; and Public Trust Uses, including wildlife, aquatic habitat, fisheries, and recreation.**
- *[Our comment was not identified in the response to comments. No changes to the GSP text were made.]* The types and locations of environmental uses, species and habitats supported, instream flow requirements, and other designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the Subbasin should be specified. **To identify environmental users, please refer to the following:**
  - The NC Dataset (https://gis.water.ca.gov/app/NCDatasetViewer/) which identifies potential presence of groundwater dependent ecosystems in this basin
  - The list of freshwater species located in the Kings Subbasin in Attachment C of this letter. Please take particular note of the species with protected status.
  - CDFW's California Natural Diversity Database (CNDDB) - https://www.wildlife.ca.gov/Data/CNDDB
  - USFWS's IPAC report for the McMullin Area - https://ecos.fws.gov/ipac/

Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8).

[Section 2.2.1 Monitoring and Management Programs - Surface Water Monitoring (p. 2-20)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This section briefly describes the types of monitoring performed by the Kings River Water Authority (KRWA), the Friant Water Authority (FWA) and the San Luis Delta-Mendota Water Authority (SLDMWA), and the ditch companies. There is no mention of ISWs or GDEs or how they are monitored. **Please explain the relationship of existing stream flow monitoring to the protection of ISWs and GDEs, and if there are instream flow criteria for the ISWs.**

[Section 2.2.2.4 San Joaquin River Restoration Program (p. 2-26 to 2-27)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The San Joaquin River Restoration Program (SJRRP) requires the release of flows from Friant Dam to the confluence with the Merced River to support the life-stages of salmon and other fish species. These restoration flows will allow more groundwater seepage when the system is fully operational, estimated to be after 2029. This section should discuss or reference any instream flow requirements, especially flow needs for critical species, including the amount, time of year when the flow minimum is specified, the duration, the species for which it applies, associated permits that set forth the requirements, and the regulating agency setting forth the compliance requirements. **Please discuss the potential impact of the SJRRP on the wetlands and potential GDEs present along or adjacent to the river.**

[Section 2.3 Relation to General Plans (p. 2-28 to 2-29)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The Fresno County General Plan was adopted prior to the development of the GSA. This section should be modified to include a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals. **Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin and if they are associated with critical, GDE or ISW habitats. **Please identify all relevant HCPs and NCCPs within the Subbasin, and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Please refer to the Critical Species Lookbook[2] to review and discuss the potential groundwater reliance of critical species in the basin. **Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.**

[Section 2.3.4 Permitting New or Replacement Wells (p. 2-29 to 2-30)]

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[2] *Available online at:* *https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/*

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please include a discussion of how future well permitting will be coordinated with the GSP to assure achievement of the Plan's sustainability goals.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF vs. SWRCB and Siskiyou County, No. C083239). **Compliance of well permitting programs with this requirement should be stated in the GSP.**

<u>Checklist Items 5, 6, and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)</u>

[Section 3.1.7 Cross-sections (p. 3-15)]

- *[The GSA's response does not address our comment. Minor changes to the GSP text do not address our comment.]* The basinwide cross sections provided in Figures 3-9 through 3-14 (pp. 3-16 through 3-21) are regional, and do not include a graphical representation of the manner in which shallow groundwater may interact with ISWs or GDEs that would allow the reader to understand this topic. The cross-sections have been taken from a 1969 source and, as reproduced in the GSP, are very difficult to read and understand. **Please reproduce the regional cross-sections so that they can be understood by the reader and update them to illustrate data obtained from more recent well installations. Include an example near-surface cross sections that depicts the conceptual understanding of shallow groundwater and river interactions at different locations, as well as any potential GDEs and ISWs**.

[Section 3.1.8.1 Geologic Formation (pp. 3-22 to 3-25)]

- *[The GSA's response states: "The wells in MAGSA's monitoring network are only in the unconfined zone." This response addresses our comment, however no GSP text changes were made.]* There are two water-bearing formations, the younger alluvium and the deeper, older alluvium. In the western part of the Subbasin, they are divided by three clay layers, A, C and E clays; the E-clay is commonly known as the Corcoran Clay. Confined conditions exist below the Corcoran Clay. The document states that "At the time of writing this HCM, insufficient data was available to verify if confined groundwater conditions exist between the C-Clay and E-Clay within the MAGSA; however, based on the available data from nearby areas, it is assumed that confined conditions exist between the two in the MAGSA. This is still being investigated by the Kings Basin Coordination Efforts" (pp. 3-25). The extent of the clay layers is shown in Figure 3-17 (p. 3-26). **It is important to determine if confined conditions exist between the C-Clay and the E-Clay, and to confirm that only wells with screened intervals in the unconfined aquifer are being used to compare with surface water to identify and confirm potential GDEs.**

[Section 3.1.8.1 Aquifer Characteristics and Properties (p. 3-27)]

- *[The figures labels have been corrected. The GSA's response does not address the rest of our comment and no changes to the GSP text were made.]* In the McMullin Area, the base of the usable aquifer corresponds with the base of fresh water, generally defined as groundwater with total dissolved solids (TDS) of 2,000 milligrams per liter (mg/l) (KDSA, 2010). Figure 3-17 (p. 3-28) shows the base of the aquifer defined this way but is mislabeled as Figure 3-13. **Please correct figure labels for Figures 3-17, 3-18, and 3-19 (labeled as 3-13, 3-14 and 3-15).** As noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** Properly defining the bottom of the basin will prevent the possibility of extractors with wells deeper than the basin boundary from claiming exemption from SGMA due to their well residing outside the vertical extent of the basin boundary.

[Section 3.1.12 Recharge and Discharge Areas (p. 3-40 to 3-41]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Wetlands were mapped along the San Joaquin River, as identified from US Forest Service's National Wetland Inventory, according to the GSP. Two other areas are mentioned, the 1,800-acre Kerman Ecological Reserve and the 930-acre Alkali Sink, both consisting of grassland habitat with seasonal vernal pools. **Please discuss in the GSP that portions of these Reserves are considered potential GDEs and refer to Figure 3-75. Also, if the Wetland Inventory was in fact the US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI), then correct the text and reevaluate the data. The NWI does not always include or segregate separate existing wetlands that are on the periphery of other features. Please describe the wetland types in more detail. If they are truly vernal pools confined by a clay layer then they are not GDEs, but they must meet the criteria of a vernal pool as described by the California Rapid Assessment Methodology or the United States Army Corps of Engineers to qualify.**

Checklist Items 8, 9, and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)

[Section 3.2.7 Surface Water and Groundwater Interconnection (p. 3-108 to 3-114)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please provide depth to groundwater contour maps. See Attachment D for best practices for completing this step. Specifically, ensure that the first step is contouring groundwater elevations, and the subtracting this layer from land surface elevations from a DEM to estimate depth to groundwater contours across the landscape**. This will provide much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make.

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. The text states that "It has been adequately determined that there is no evidence as to the presence of continuous interconnected surface water groundwater systems within the MAGSA along the San Joaquin River therefore this criterion is not applicable to the MAGSA" (p. 3-108). TNC disagrees with the conclusion that the interconnection must be continuous in time for surface water to be considered interconnected. In fact, the text state that "When river discharge is high, the groundwater elevations in wells MW-09-36 and MW-09-37 are higher than the channel bed elevation" (p. 3-110). No data were included to show the relationship between the depth to groundwater and the riverbed. **Please provide a cross-section and/or corresponding hydrographs to show the relationship between the river channel and the depth to groundwater at wells near the river.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* ISWs are best estimated by first determining which reaches are completely disconnected from groundwater. This approach would involve comparing groundwater elevations with a land surface Digital Elevation Model that could identify which surface waters have groundwater consistently below surface water features, such that an unsaturated zone would separate surface water from groundwater. Groundwater elevations that are always deeper than 50 feet below the land surface can be used to identify the aboveground reaches as disconnected surface waters. The data presented in Figure 3-71 (p. 3-110) indicate that the depth to groundwater in monitoring well MW-09-39 was within 25 feet of the ground surface from October 2009 through January 2017, and within 5 feet in April 2011 and on several occasions since January 2017. The data clearly show that at times the surface water and groundwater are interconnected. **Please evaluate with depth to groundwater contour maps as described above, and see Attachment D for best practices for completing this step.** TNC disagrees with the text on p. 3-113 stating "Interconnected surface water sustainable management criteria do not apply within the MAGSA reaches of the San Joaquin River…". Without further documented evidence, ISWs must be retained for the consideration of sustainable management criteria. **Please remove or restate this sentence. Expand the discussion of ISWs to include the above referenced recommendations on identifying and mapping ISWs and provide discussion of the depletions on specific rivers. Please reconcile any data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP to improve ISW mapping.**

[Section 5.7 Depletion of Interconnected Surface Water (p. 5-42)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The document states that this criterion is not applicable to the MAGSA because the flow in the San Joaquin River is dry "at various times of the calendar year" (p. 5-42) below the Bifurcation Structure (Figure 5-10). There is no discussion of how the flow regime will change as part of the SJRRP. **Please provide a discussion of the expected effect of the SJRRP on flows, GDEs and ISWs along the San Joaquin River.**

<u>Checklist Items 11 to 15, Identifying and Mapping GDEs (23 CCR §354.16)</u>

[Section 3.2.8 Groundwater Dependent Ecosystems (p. 3-114)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The NC dataset is a starting point for GSAs to identify GDEs in their basin. The NC dataset comprises 740 acres of potential GDEs for the McMullin Area. The text states that rejected GDEs are depicted in purple in Figures 3-75 and 3-76, however this is not the case. **Please map the original NC dataset, and clearly document which polygons were added (and what local sources were used to identify them), removed (and the removal reason), and kept (from the original NC dataset)**. The basin's GDE shapefile, which is submitted via the SGMA Portal, should also include two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were added or removed).
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The text states on p. 3-114: "As seen in Figure 3-75 and Figure 3-76, groundwater elevations can be extremely low throughout MAGSA, indicating a lack of groundwater dependent ecosystems (GDEs)," however these figures do not show groundwater elevations or depth to groundwater. **Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network**. Specifically, please note:
    - *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please provide depth to groundwater contour maps as described above as related to Checklist Items 8, 9 and 10 for Section 3.2.7**
    - *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The text states (p. 3-114): "Recognizing that much of the Kings Subbasin has a depth to groundwater greater than the deepest vegetative GDE rooting depth of thirty feet, many of the GDEs identified in the NC Dataset Viewer were mischaracterized." In TNC's GDE Guidance, the depth criterion of 30 feet is presented as a criterion for *inclusion*, not a standalone criterion for *exclusion*. In other words, if groundwater is within 30

feet of the ground surface, then a GDE can be identified. If it is not, then further analysis must be conducted (see Appendix III of the GDE Guidance, Worksheet 1, for other indicators of GDEs). In addition, many phreatophytes can and will root deeper than 30 feet, but are commonly constrained by the saturated zone at and below the ground water table. As groundwater declines or rises, roots redistribute over the water table in the unsaturated zone. This may happen on a seasonal and annual basis. **Please remove the 30-foot criteria for excluding GDEs and present a more comprehensive analysis for identifying GDEs in the Subbasin, as outlined in Appendix III (Worksheet 1) of the GDE Guidance.**

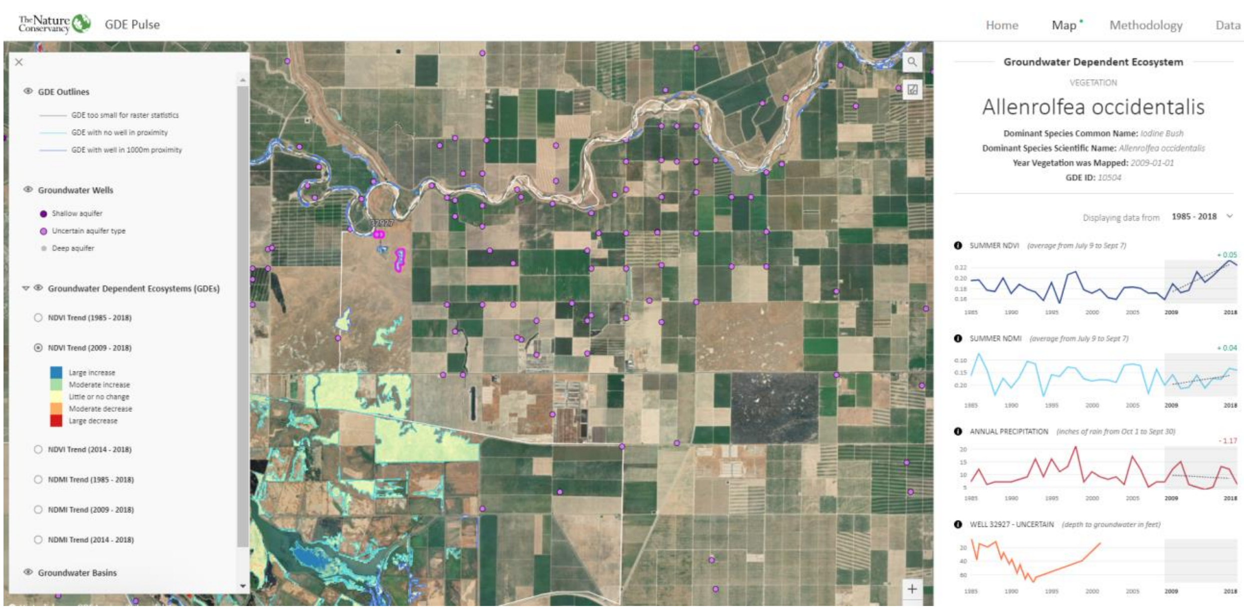
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The actual rooting depth of vegetation growing in the area should be considered. Furthermore, rooting depths are likely to spatially vary based on the local hydrologic conditions available to the plant, as mentioned above. Maximum rooting depths do not take capillary action into consideration, which will vary with soil type and is an important consideration since woody phreatophytes generally do not prefer to have their roots submerged in groundwater for extended periods of time, and hence can access groundwater at deeper depths. **Please indicate what vegetation is present in the possible GDEs.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The Spring 2017 groundwater contours were used to exclude any GDE where the depth to groundwater was deeper than 30 feet. It is highly advised that seasonal and interannual groundwater fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one point in time (e.g., Spring 2017) can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. **We highly recommend using depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. Ensure that groundwater condition data prior to the SGMA benchmark date of January 1, 2015 is included in the analysis. Please refer to our comment above related to Checklist Items 8-10 for Section 3.2.7, and to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network**.
- *[One sentence added to GSP text: "This 100-ft buffer is based on a California Department of Transportation typical wetland setback (CDOT, 2019)." However, this addition to the text does not address our comment, nor does this buffer rule describe whether groundwater conditions in the basin are supporting GDEs.]* The text states on page 3-116: "The Kings Subbasin also categorized GDEs within 100 feet of the Kings River and the San Joaquin

River as "Possible GDEs." **Please clarify how the 100-foot buffer was used to include or exclude GDEs in the McMullin Area, and how this is supported by groundwater level and plant physiological data. If there is a potential GDE near the river, we suggest the entire GDE is included, rather than using an arbitrary 100-foot cutoff.**

<u>Checklist Items 16 to 20, Describing GDEs (23 CCR §354.16)</u>

[Section 3.2.8 Groundwater Dependent Ecosystems (p. 3-114)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Once potential GDEs are identified, please provide information on the historical or current groundwater conditions in the GDEs or the ecological conditions present**. Refer to GDE Pulse (https://gde.codefornature.org; See Attachment E of this letter for more details) or any other locally available data to describe depth to groundwater trends in and around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in the McMullin Area:



- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please provide an ecological inventory (see Appendix III, Worksheet 2 of the GDE Guidance) for all potential GDEs that includes the vegetation types or habitat types and rank the GDEs as having a high, moderate or low value; and what characterizes the rank.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Please identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat were**

found in or near any of the GDEs since some organisms rely on uplands and wetlands during different stages of their lifecycle. Resources for this include the list of freshwater species located in the Kings Subbasin can be found in Attachment C of this letter, the Critical Species Lookbook, and CDFW's CNDDB database.

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **For each identifiable GDE unit with supporting hydrological datasets please include the following:**
  - Plot and provide hydrological datasets for each GDE.
  - Define the baseline period in the hydrologic data.
  - Classify GDE units as having high, moderate, or low susceptibility to changes in groundwater.
  - Explore cause-and-effect relationships between groundwater changes and GDEs.
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **For each identifiable GDE unit without supporting hydrological datasets please describe data gaps and/or insufficiencies.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Compile and synthesize biological data for each GDE unit by including:**
  - Plots of biological datasets for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.
  - Describe data gaps/insufficiencies.
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* **Description of potential effects on GDEs, land uses, and property interests, including:**
  - Cause-and-effect relationships between GDE and groundwater conditions.
  - Impacts to GDEs that are considered to be "significant and unreasonable".
  - Report known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities.
  - Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).
  - Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.

<u>Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)</u>

[Section 3.3.8 Historical Water Budget (p. 3-131)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The text states that groundwater pumping and the lack of surface water in the McMullin Area has induced large groundwater flows into the McMullin Area. This inflow has been included in the historical budget, but it is not included in future budgets. **Please quantify the estimated amount of induced groundwater flow in the historical budget, clearly indicate if this amount is included in the**

current budget, and why there are differences in inclusion from historical, current and future budgets.

- *[The GSA's response states: "The only riparian and wetland areas are located along the southern side of the San Joaquin River. These cover relatively minor areas, and the evapotranspiration were estimated as part of the total evaporation from the San Joaquin River, which was estimated internally as part of the River seepage estimates. Native vegetation evapotranspiration would be from local rainfall and is captured in the Water Budget variable 'Rainfall Evaporation and Runoff.'" Please include a term for native or riparian vegetation and wetlands evapotranspiration in the McMullin Area historical, current, and future water budgets.]* **Please clarify whether a term is included for native or riparian vegetation evapotranspiration and for wetlands in the McMullin Area historical, current, and future water budgets.**

<u>Checklist Items 23 to 25 – Sustainability Goal (23 CCR §354.24)</u>

[Section 4.1 Sustainability Goal (p. 4-2)] The Sustainability Goal does not consider GDEs or ISWs.

- *[The GSA's response does not address our comment. Minor changes to the GSP text do not address our comment.]* **Since GDEs are likely present in the Subbasin (see comments under Checklist Items 16-20) they should be recognized as beneficial users of groundwater and should be included in the Sustainability Goal. In addition, a statement about any intention to address pre-SGMA impacts should be included.**
- *[The GSA's response does not address our comment. Minor changes to the GSP text do not address our comment.]* The Plan states that there are time periods of ISW connectivity along the San Joaquin River; however, they are dismissed because they are not continuously connected. **TNC notes evidence of connectivity between surface water and groundwater and potential GDEs have been identified near the San Joaquin River. We disagree with the statement that there are not ISWs within the GSA. Even though the ISWs are not continuously connected (see comments under Checklist Items 8-10) they should be included in the Sustainability Goal.**
- *[The GSA's response does not address our comment. Minor changes to the GSP text do not address our comment.]* GDEs are dependent, in part, on suitable water quality; however, the Plan only considers water quality for irrigation and domestic use. **TNC recommends including ISWs and their potential GDEs in the sustainability goal and criteria. Since GDEs may be affected by water quality, they should be included in the Sustainability Goal.**

[Section 4.2 Groundwater Levels (p. 4-3)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Figure 4-1 (p. 4-4) represents Path A as shown in the DWR Sustainable Management Criteria BMP (Figure 15, Potential Paths to Sustainability). This is a problematic concept to implement since this Subbasin is already designated as being critically overdrafted, despite that the McMullin Area is not yet experiencing undesirable results. This approach may slow recovery of adjacent areas or have unintended consequences that contribute to undesirable results within the McMullin Area and adjacent areas. Please elaborate on how this continued groundwater decline will affect the ability of adjacent GSP areas within the Subbasin to recover, and how potential unintended consequences within the McMullin Area and adjacent areas will be evaluated.

Checklist Item 26 – Measurable Objectives (23 CCR §354.30)

[Sections 4.2.3 Measurable Objectives for Groundwater Levels (p. 4-10)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This Measurable Objective does not consider GDEs. **Please include GDEs (see comments under Checklist Items 8-10) in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Sections 4.5.3 Measurable Objectives for Water Quality (p. 4-27)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This Measurable Objective does not consider water quality needs of GDEs. **Please include a discussion about GDEs and water quality and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Section 4.7 Interconnected Groundwater Surface Water Systems (p. 4-42)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The Measurable Objectives do not consider ISWs. The Plan states that there are time periods of ISWs along the San Joaquin River; however, they are dismissed because they are not continuously connected. Even though the ISWs are not continuously connected they should be included in the Measurable Objectives because they are still connected. **Please include ISWs (see comments under checklist items 16-20) in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The analysis for potential depletion of ISWs in Section 4.7 should include all beneficial users of surface water that could be affected by groundwater withdrawals, including environmental. The SJRRP identifies instream flow needs for salmon in Reach 2a which forms the northern border in the Plan area (http://www.restoresjr.net/about/overview-map/). **Please include instream flow requirements in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

Checklist Item 27-29 – Minimum Thresholds (23 CCR §354.28)

[Sections 4.2.2 Minimum Thresholds for Groundwater Levels (p. 4-6)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This Minimum Threshold does not consider GDEs. **Please include GDEs in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Sections 4.5.2 Minimum Thresholds for Water Quality (p. 4-23)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This Minimum Threshold does not consider water quality needs of GDEs. **Please include a discussion about GDEs and water quality and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Section 4.7 Interconnected Groundwater Surface Water Systems (p. 4-42)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The Minimum Thresholds do not consider GDEs. GDEs are often adjacent to streams or associated with riparian corridors where ISWs exist, even if only seasonally or are discontinuous along a longitudinal profile. ISWs that are not continuously connected spatially and/or temporally are still ISWs and should not be excluded from this GSP. **Please include GDEs and ISWs in this section and whether the minimum thresholds will help achieve the sustainability goal as it pertains to the environment.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The analysis for potential depletion of ISWs in Section 4.7 should include all beneficial users of surface water that could be affected by groundwater withdrawals, including environmental users. Instream flow requirements for salmon are identified in the SJRRP for a region that forms the northern border in the Plan area (http://www.restoresjr.net/about/overview-map/). **Please include instream flow and critical habitat requirements in this section and whether the minimum thresholds will help achieve the sustainability goal as it pertains to the environment.**

Checklist Item 30-46 – Undesirable Results (23 CCR §354.26)

[Section 4.2.1 Undesirable Results (for Groundwater Levels) (p. 4-3)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This section only describes undesirable results relating to human beneficial uses of groundwater and neglects environmental beneficial uses that could be adversely affected by chronic groundwater level decline. **Please add "potential**

adverse impacts to GDEs" to the list of potential undesirable results presented in Section 4.

- *[No response required.]* The GDE Pulse web application developed by TNC provides easy access to 35 years of satellite data to view trends of vegetation metrics, groundwater depth (where available), and precipitation data. This satellite imagery can be used to observe trends for NC dataset polygons within and near the GSA. Over the past 10 years (2009-2018), some NC dataset vegetation polygons have experienced adverse impacts to vegetation growth and moisture along the San Joaquin River. An example screen shot from the GDE Pulse tool is presented under Checklist Items 11-15 above.

[Section 4.5.1 Undesirable Results (for groundwater quality) (p. 4-20)]

- *[The GSA's response does not address our comment. Minor changes to the GSP text do not address our comment.]* This section only describes undesirable results in terms of meeting drinking water standards. The following is a link to a paper by Smith, Knight and Fendorf (2018) titled "Overpumping leads to California groundwater arsenic threat": (https://www.nature.com/articles/s41467-018-04475-3). **The section should be modified to state that overpumping and dewatering of aquitards has been identified as a potential source of elevated arsenic concentrations above drinking water standards in San Joaquin Valley aquifers. In addition, any potential undesirable results from degradation of water quality that may impact GDEs and freshwater species in the area should be discussed in this section.**

[Section 4.7 Interconnected Groundwater Surface Water Systems (p. 4-42)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This section does not consider Undesirable Results for Interconnected Groundwater Surface Water Systems]. The Plan states that there are time periods of ISWs along the San Joaquin River; however, they are dismissed because they are not continuously connected. **Even though the ISWs are not continuously connected they should be included in the Undesirable Results. The analysis for potential depletion of ISWs in Section 4.7 should include all beneficial users of surface water that could be affected by groundwater withdrawals, including environmental. The SJRRP identifies instream flow needs for salmon in Reach 2a which forms the northern border in the Plan area (http://www.restoresjr.net/about/overview-map/). Please include instream flow requirements and critical habitat designations in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)

[Section 5.2 Groundwater Levels (pp. 5-3 to 5-16)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The text states that the unconfined, semi-confined and confined aquifers will be monitored separately. The proposed wells to be used for monitoring groundwater levels are shown in Figure 5-3 (p. 5-9). Many of the monitoring wells are missing well construction information, which is acknowledged as a data gap on p. 5-14. It is not clear exactly which aquifer is being monitored using the proposed system of 152 wells. **To accurately characterize GDEs, please clarify how the unconfined aquifer will be monitored and how many wells will be used.**

[Section 5.7 Depletion of Interconnected Surface Water (pp. 5-42 to 5-49)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* The text states several times that because the MAGSA is not setting criteria for ISWs, further expansion of the monitoring network or addressing data gaps is not deemed applicable at this time. However, because the identification and mapping of ISWs in Section 3.2.7 of the GSP was not adequate (see our comments on this section above), data gaps must be recognized, and a monitoring plan put in place to reconcile these data gaps prior to dismissal of these sensitive habitats. **Please reconcile these data gaps with specific recommendations (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features to improve ISW mapping and inform an adequate analysis.**
- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater <u>*and related surface conditions*</u> (emphasis added). Groundwater level monitoring alone may be insufficient to establish a linkage between groundwater extraction and potentially resulting impacts to environmental resources associated with GDEs and ISWs. The cause-effect relationship between groundwater levels and the biological responses that could result in significant and unreasonable impacts to ISWs and GDEs depends on a number of complicated factors, and this relationship is not characterized or discussed. As such, it is not possible to determine whether the proposed monitoring is sufficiently protective to ensure significant and unreasonable impacts to GDEs and ISWs will be prevented. **To clarify if GDEs are present, consider adding monitoring of potential GDEs at any locations where ISWs have been present regardless of their seasonal or discontinuous nature.**

<u>Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)</u>

[Section 6.1 Introduction (p. 6-1) and 6.2.14 Project Ranking (p. 6-90)]

- *[Our comment was adequately addressed through GSP text changes. Thank you for including environmental benefits and multiple benefits as criteria for assessing project priorities.]* The Subbasin area includes many GDEs and ISWs (see our comments under checklist items 8-10 and 16-20 above) that are beneficial uses and users of groundwater, and may include potentially sensitive resources and protected lands. Environmental resource protection needs should be considered in establishing project priorities. In addition, consistent with existing grant and funding guidelines for SGMA-related work, priority should be given to multi-benefit projects that can address water quantity as well as providing environmental benefits or benefits to disadvantaged communities. **Please include environmental benefits and multiple benefits as criteria for assessing project priorities.**

[Section 6.2 Projects (pp. 6-5 to 6-93)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This section identifies many important projects; however, the descriptions of Measurable Objectives for these projects only identifies benefits to water level and storage. **Because maintenance or recovery of groundwater levels or construction of recharge facilities may have potential environmental benefits, in many cases it would be advantageous to demonstrate multiple benefits from a funding and prioritization perspective.**
    - **For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.**
    - If ISWs will not be adequately protected by those listed, **please include and describe additional management actions and projects targeted for protecting ISWs.**
    - Recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such facilities have been incorporated into local Habitat Conservation Plans (HCPs) and Natural Community Conservation Plans (NCCPs), more fully recognizing the value of the habitat that they provide and the species they support. For projects that construct recharge ponds, **please consider identifying if there is habitat value incorporated into the design and how the recharge ponds will be managed to benefit environmental users.**
    - For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

[Section 6.3 Management Actions (p. 6-94)]

- *[The GSA's response does not address our comment and no changes to the GSP text were made.]* This section discusses the Management Actions for GSP implementation and SGMA compliance; however, these actions are focused on meeting groundwater level and storage measures and do not include support for GDEs or ISWs. **Please consider modifying the Management Actions to include education and outreach for protection of GDEs and ISWs. Please update Section 6.3.1.2 (p. 6-97) to include GDEs and ISWs.**

Attachment C

Freshwater Species Located in the Kings Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Kings Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[3]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[4] as well as on TNC's science website[5].

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Birds				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	BCC	SCC	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		SCC	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		SCC	

[3] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[4] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[5] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		SCC	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cypseloides niger	Black Swift	BCC	SCC	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	BCC	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	BCC	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		SSC	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			

Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		SSC	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		SSC	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		SSC	BSSC - Third priority
Crustaceans				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	SSC	IUCN - Vulnerable
Branchinecta mesovallensis	Midvalley Fairy Shrimp		SSC	
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	SSC	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		SSC	IUCN - Near Threatened
Fishes				
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Cottus asper ssp. 1	Prickly sculpin			Least Concern - Moyle 2013
Cottus gulosus	Riffle sculpin		SSC	Near-Threatened - Moyle 2013
Gasterosteus aculeatus microcephalus	Inland threespine stickleback		SSC	Least Concern - Moyle 2013

Lampetra hubbsi	Kern brook lamprey		SSC	Vulnerable - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		SSC	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		SSC	Near-Threatened - Moyle 2013
Mylopharodon conocephalus	Hardhead		SSC	Near-Threatened - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus tshawytscha - CV fall	Central Valley fall Chinook salmon	SSC	SSC	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV late fall	Central Valley late fall Chinook salmon	SSC		Endangered - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
Herps				
Actinemys marmorata marmorata	Western Pond Turtle		SSC	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus boreas halophilus	California Toad			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	SSC	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	SSC	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	SSC	ARSSC
Taricha torosa	Coast Range Newt		SSC	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis fitchi	Valley Gartersnake			Not on any status lists
Thamnophis sirtalis sirtalis	Common Gartersnake			
Insects and Other Invertebrates				
Acentrella insignificans	A Mayfly			

Acentrella spp.	Acentrella spp.			
Anax junius	Common Green Darner			
Argia agrioides	California Dancer			
Argia emma	Emma's Dancer			
Argia nahuana	Aztec Dancer			
Argia spp.	Argia spp.			
Baetidae fam.	Baetidae fam.			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Brillia spp.	Brillia spp.			
Chironomidae fam.	Chironomidae fam.			
Cordulegaster dorsalis	Pacific Spiketail			
Cricotopus spp.	Cricotopus spp.			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Enallagma cyathigerum				Not on any status lists
Epeorus spp.	Epeorus spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Erpetogomphus compositus	White-belted Ringtail			
Erythemis collocata	Western Pondhawk			
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon spp.	Fallceon spp.			
Glossosoma spp.	Glossosoma spp.			
Glossosomatidae fam.	Glossosomatidae fam.			
Heptageniidae fam.	Heptageniidae fam.			
Hetaerina americana	American Rubyspot			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Ischnura perparva	Western Forktail			
Lepidostoma baxea	A Caddisfly			
Lepidostoma spp.	Lepidostoma spp.			
Lestes congener	Spotted Spreadwing			

Libellula croceipennis	Neon Skimmer			
Libellula saturata	Flame Skimmer			
Limnophyes spp.	Limnophyes spp.			
Ochrotrichia burdicki	A Caddisfly			
Pachydiplax longipennis	Blue Dasher			
Pantala flavescens	Wandering Glider			
Pantala hymenaea	Spot-winged Glider			
Plathemis lydia	Common Whitetail			
Polypedilum spp.	Polypedilum spp.			
Protoptila spp.	Protoptila spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Serratella micheneri	A Mayfly			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Stylurus olivaceus	Olive Clubtail			
Telebasis salva	Desert Firetail			
Tramea lacerata	Black Saddlebags			
Tricorythodes spp.	Tricorythodes spp.			
Zoniagrion exclamationis	Exclamation Damsel			
Mammals				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
Mollusks				
Anodonta californiensis	California Floater		SSC	
Ferrissia spp.	Ferrissia spp.			
Gyraulus spp.	Gyraulus spp.			
Margaritifera falcata	Western Pearlshell		SSC	
Menetus spp.	Menetus spp.			
Physa spp.	Physa spp.			
Physella virgata	Protean Physa			CS
Pisidium spp.	Pisidium spp.			
Planorbella tenuis	Mexican Rams-horn			CS
Planorbella trivolvis	Marsh Rams-horn			CS

Pyrgulopsis stearnsiana	Yaqui Springsnail			T
Sphaeriidae fam.	Sphaeriidae fam.			
Plants				
Alnus rhombifolia	White Alder			
Alopecurus carolinianus	Tufted Foxtail			
Alopecurus saccatus	Pacific Foxtail			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Carex pellita	Woolly Sedge			
Castilleja campestris succulenta	Fleshy Owl's-clover	Threatened	Endangered	CRPR - 1B.2
Cephalanthus occidentalis	Common Buttonbush			
Chloropyron palmatum	NA	Endangered	SSC	CRPR - 1B.1
Cyperus acuminatus	Short-point Flatsedge			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus squarrosus	Awned Cyperus			
Downingia bella	Hoover's Downingia			
Downingia cuspidata	Toothed Calicoflower			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Elodea canadensis	Broad Waterweed			
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle		SSC	CRPR - 1B.2
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euphorbia hooveri	NA			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Hydrocotyle umbellata	Many-flower Marsh-pennywort			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			

Hypericum anagalloides	Tinker's-penny			
Juncus acuminatus	Sharp-fruit Rush			
Juncus xiphioides	Iris-leaf Rush			
Lasthenia ferrisiae	Ferris' Goldfields		SSC	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lilium pardalinum pardalinum	Leopard Lily			
Ludwigia palustris	Marsh Seedbox			
Ludwigia peploides peploides	Floating Water Primrose			Not on any status lists
Marsilea vestita vestita	Hairy Pepperwort			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Mimulus latidens	Broad-tooth Monkeyflower			
Mimulus pilosus	Snouted Monkey Flower			Not on any status lists
Mimulus tricolor	Tricolor Monkeyflower			
Myosurus minimus	Little Mouse Tail			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Orcuttia inaequalis	San Joaquin Valley Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Orcuttia pilosa	Hairy Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Persicaria lapathifolia	Common Knotweed			Not on any status lists
Persicaria punctata	Dotted Smartweed			Not on any status lists
Phalaris arundinacea	Reed Canarygrass			
Pilularia americana	Pillwort			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys distantiflorus	California Popcorn-flower			
Plagiobothrys undulatus	Coast Allocarya			Not on any status lists
Platanus racemosa	California Sycamore			
Pogogyne douglasii	Douglas' Pogogyne			
Potamogeton diversifolius	Water-thread Pondweed			
Potamogeton nodosus	Longleaf Pondweed			
Potamogeton pusillus pusillus	Slender Pondweed			

Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Puccinellia simplex	Little Alkali Grass			
Rorippa palustris palustris	Bog Yellowcress			
Sagittaria sanfordii	Sanford's Arrowhead		SSC	CRPR - 1B.2
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Sequoia sempervirens	Coast Redwood			
Sidalcea calycosa calycosa	Annual Checker-mallow			
Tuctoria greenei	Green's Awnless Orcutt Grass	Endangered	Rare	CRPR - 1B.1
Wolffia columbiana	Columbian Watermeal			
Wolffia globosa	Asian Watermeal			
Notes: ARSSC = At-Risk Species of Special Concern BCC = Bird of Conservation Concern BSSC = Bird Species of Special Concern CRPR = California Rare Plant Rank CS = Currently Stable IUCN = International Union for Conservation of Nature SSC = Species of Special Concern				

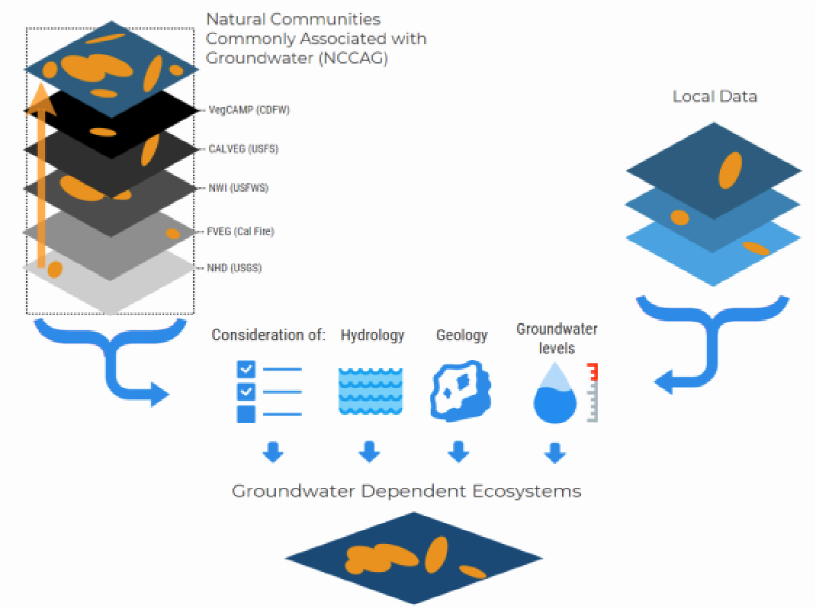
Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[6] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[7]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[6] *NC Dataset Online Viewer:* *https://gis.water.ca.gov/app/NCDatasetViewer/*

[7] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[8]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[9] on the Groundwater Resource Hub[10], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[8] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[9] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[10] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

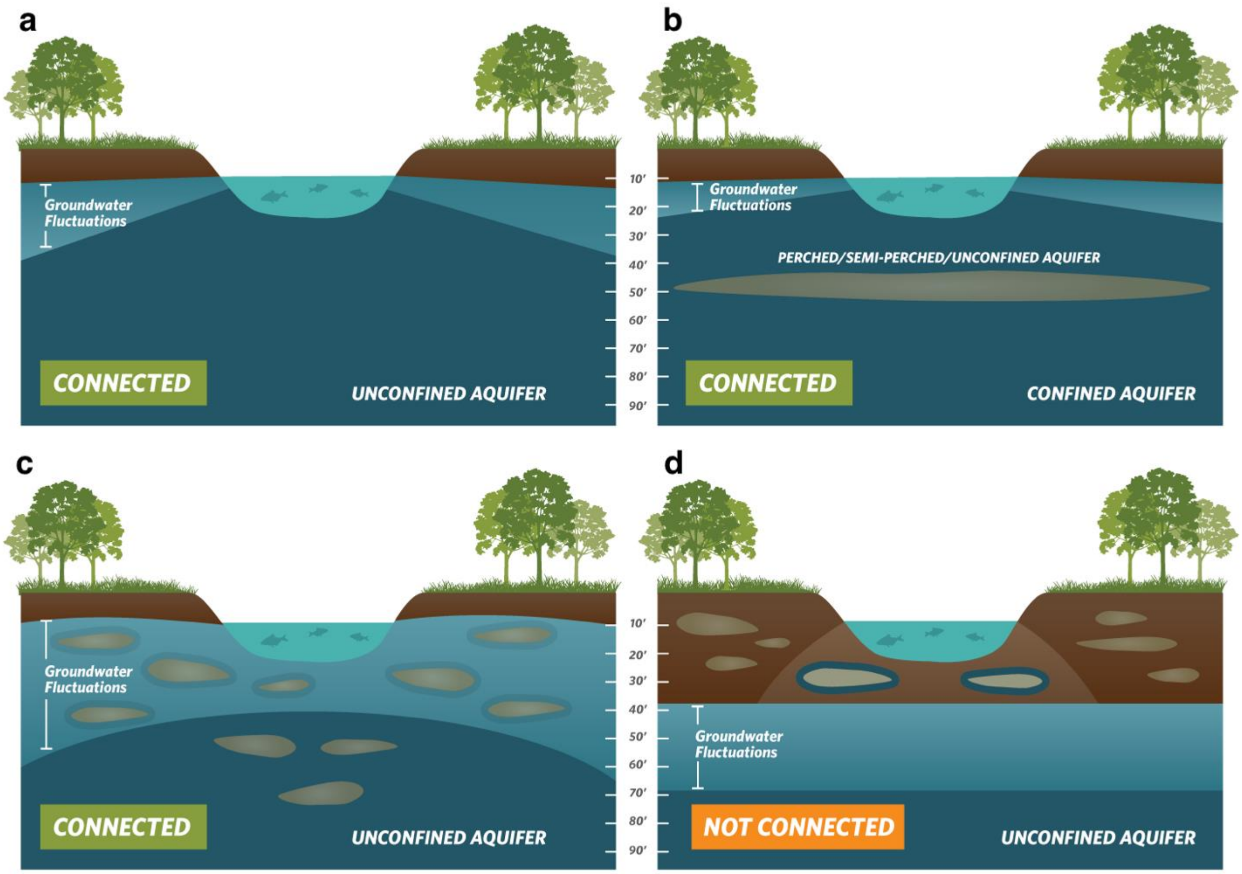

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[11] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[12] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[13] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[14]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

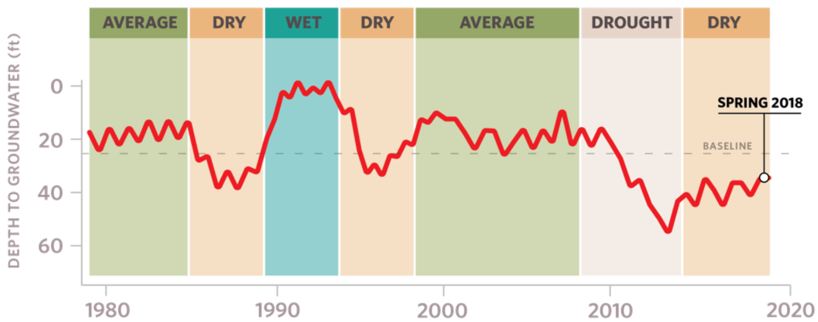

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[11] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[12] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[13] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[14] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[15], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

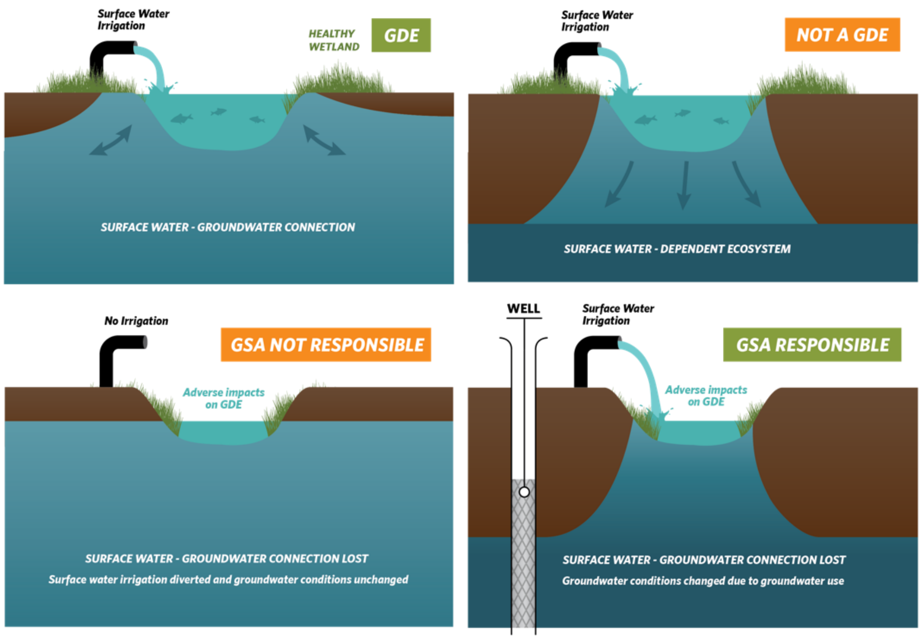

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[15] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

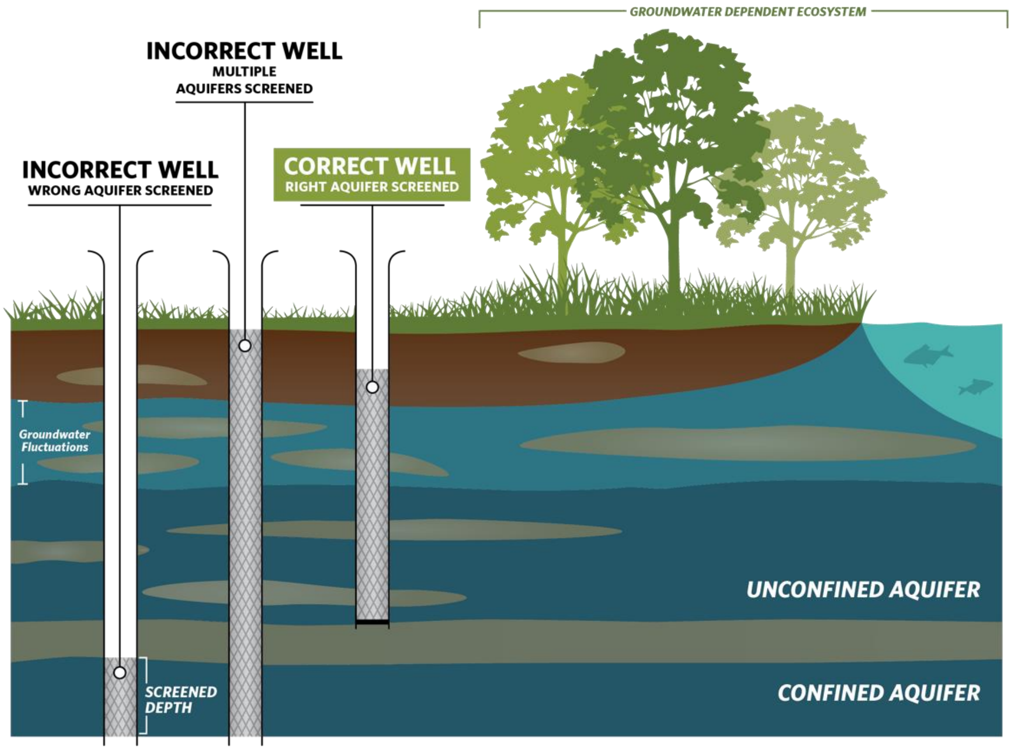

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[16] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

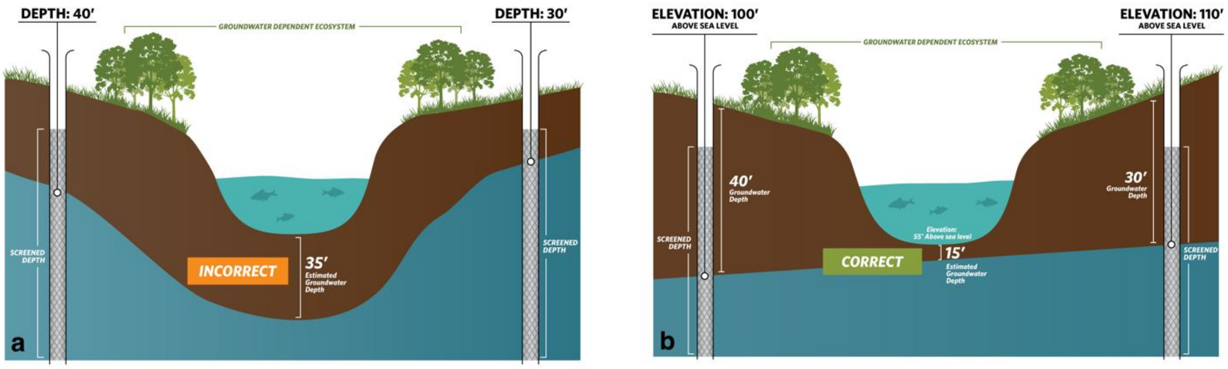

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

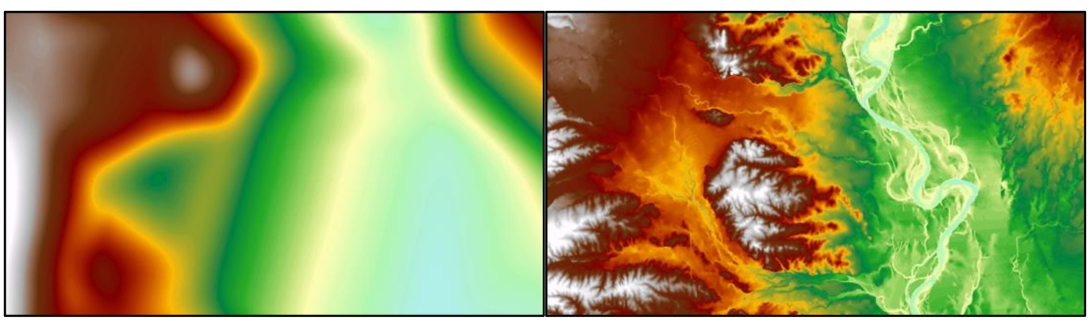

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[16] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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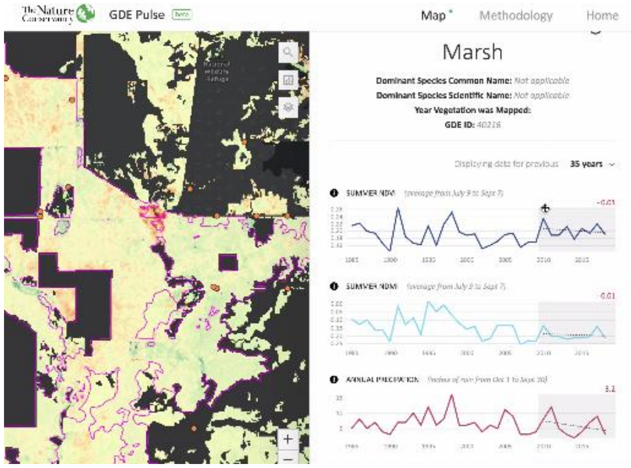
https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[17]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[18]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

[17] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[18] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F

The GSA's Response to TNC Comments of the Draft GSP is located on DWR's SGMA portal as Part 2 of 2.

Attachment G

Mapping Likely Interconnected Surface Water

The Nature Conservancy, California, May 2020

Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, ISW is defined as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:

The groundwater elevation data, available for Spring 2011-2012, and Spring and Fall 2013-2018, comes from the California Department of Water Resources (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). These data are represented as continuous raster layers that approximates "feet above or below mean sea level" based on groundwater well measurements. According to the documentation online, groundwater level measurements were selected based on measurement date and well construction information (where available) and are intended to approximate the groundwater levels in the unconfined to uppermost semi-confined aquifers. Each of the raster layer has a different extent, but all of them are limited to the Central Valley. To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

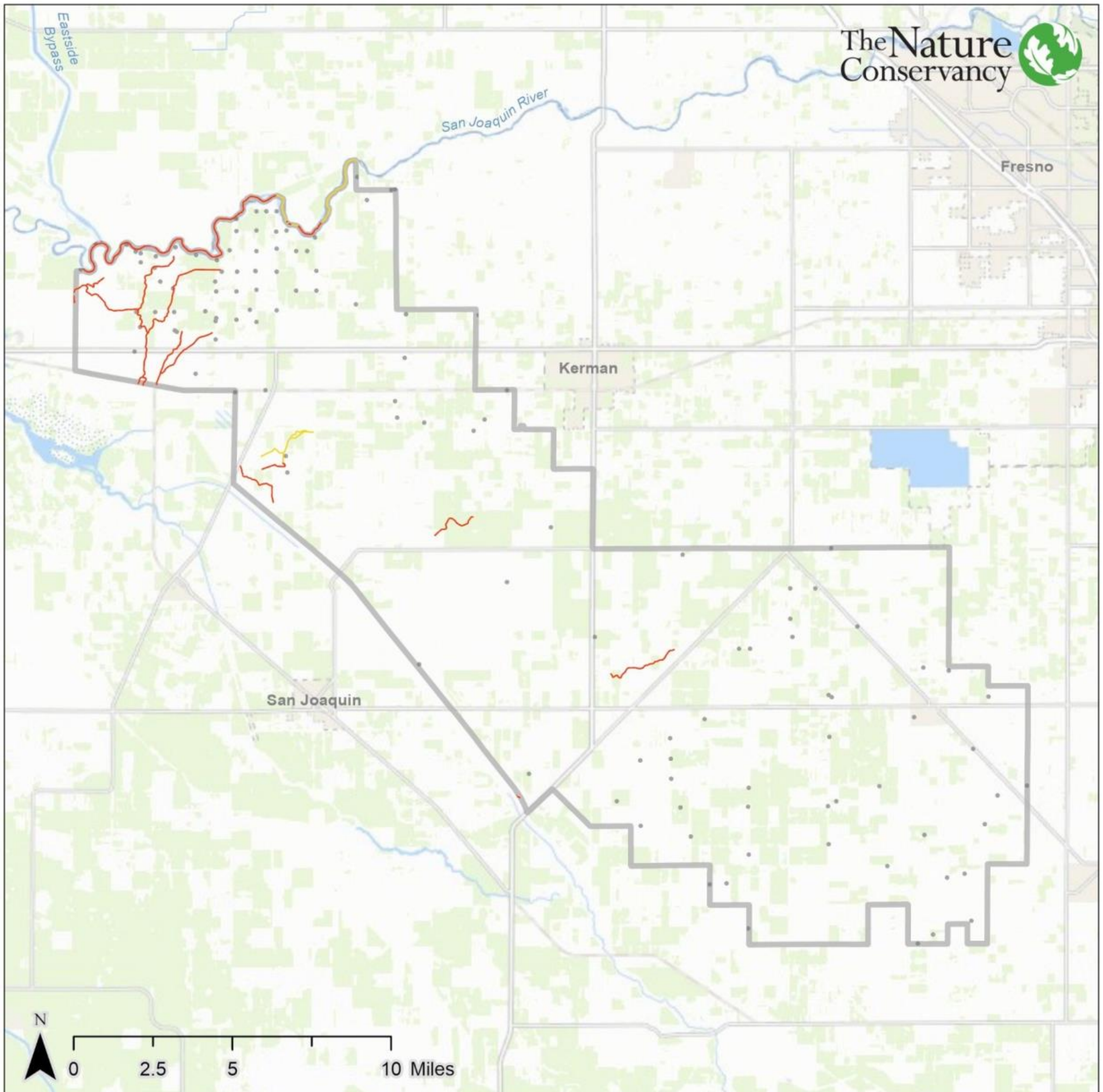
The map splits groundwater depth into four categories:

- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.
- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.

Interconnected Surface Water: Minimum Groundwater Depth (2011-2018)

McMullin Area GSA GSP



Legend

- Groundwater Sustainability Agency (GSA)
- No groundwater depth data available
- Rivers and streams with no depth data (0 miles)
- Groundwater Elevation Monitoring Point

Minimum Groundwater Depth

- Connected - Gaining: Groundwater at or above stream surface (0 miles)
- Connected - Losing: Groundwater within 20 feet of stream surface (0 miles)
- Uncertain*: Groundwater within 20-50 feet of stream surface (5.5 miles)
- Likely Disconnected*: Groundwater greater than 50 feet below stream surface (29.2 miles)

**Streams could be connected to riparian or perched aquifers or shallow aquifers that are poorly characterized. More data are needed to confirm disconnected status.*

5-022.08_Kings_McMullin

Data Sources:
CA Dept. of Water Resources Groundwater Elevation Data, gis.water.ca.gov/app/gicima/
NHD Plus V2 Streams, nhdplus.com/NHDPlus/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[19]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[20]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[21] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[19] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[20] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[21] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Merced Groundwater Subbasin Groundwater Sustainability Plan (GSP)

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Merced Groundwater Subbasin Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing sustainable groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be incomplete in addressing environmental beneficial uses and users.

While the GSP addressed environmental beneficial users in some respects, our review finds that portions of the GSP should be remedied before being approved. Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address within 180 days. In these cases, we strongly recommend that the Department set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides the GSA's response to TNC's comments on the Draft GSP. Attachment G provides a map and method summary of ISWs.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section.

We appreciate that the GSA incorporated a portion of our feedback (5 of 34 comments were addressed), however, we disagree with the components where our feedback was ignored or dismissed. This suggests a limited degree of engagement of environmental beneficial users and could result in a definition of sustainability that is biased towards a limited set of users in the basin. In our experience, the GSP did not "adequately respond(d) to comments that raise credible technical or policy issues with the Plan," (23 CCR §355.4(b)(10).

TNC recommendation: We recommend that DWR require the GSA to prioritize stakeholder engagement, resulting in stakeholder input being incorporated into the plan. Improvements can be achieved through enhancements to the stakeholder engagement plan, partnerships with NGOs and community members, more representative governance and funding decisions.

Interconnected Surface Waters (ISWs) – We are pleased to see that the GSP identified and mapped ISWs, including gaining and losing reaches and accounting for the spatial and temporal variations inherent with California's Mediterranean climate. ISWs are defined based on calculations performed with the MercedWRM model. However, while the Final GSP provides an appendix detailing the MercedWRM, there is little specific information in this document to independently assess the ISWs identified. Specifically, we find the definition of disconnected streams in the text is incorrect because the fact that the groundwater table is below the bottom of the stream bed does not always indicate an unsaturated zone that separates the stream from the groundwater. Our analysis for groundwater levels in the Merced GSP area shows many more interconnected streams including Deadman Creek, Mariposa Slough, and Owens Creek (see Attachment G).

Map and Assessment of potential ISWs:
By combining multiple years and seasons of groundwater depth data, The Nature Conservancy has determined that within the Merced Groundwater Subbasin GSP, 91.5 river miles are gaining, 123.9 are losing, and the rest are uncertain or likely disconnected (based on streams with available groundwater depth data). Attachment G contains a one-page method summary and a GSP-specific map of ISWs. The interconnected surface water displayed on the map is based on the minimum groundwater depth estimated by the California Department of Water Resources between 2011 and 2018.

TNC recommendation: We recommend that the calibration of the model is refined to better identify gaining and losing reaches and estimate the quantity and timing of streamflow depletions in the subbasin. We also recommend a more nuanced definition of a disconnected surface water body that would better reflect the expected presence of an unsaturated zone between the surface water and groundwater. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 8,246 acres of potential GDEs occur in the GSA boundary. TNC developed the *Groundwater Dependent Ecosystems under*

SGMA: Guidance for Preparing GSPs[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

The plan does not to adequately identify, map and consider GDEs. We believe that this constitutes gaps in meeting plan evaluation criteria (1), (4) and (10), as defined in the 23 CCR §355.4(b). In addition, the Plan does not satisfy the requirement to identify GDEs (23 CCR §Section 354.16(g)) and consider beneficial users throughout the plan. Our review found that NC Dataset polygons were improperly removed from the GDE map based on the following:

- GDEs were rejected on the basis that groundwater levels were greater than 30-ft at a <u>single point in time</u>. This is a technically incorrect approach since groundwater levels fluctuate over seasonal and interannual time scales due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Justifying the removal of NC dataset polygons solely based on this criterion does not acknowledge that groundwater levels temporally vary and the fact that many plant species within GDEs can access groundwater depths beyond 30-feet or have adapted water stress strategies to deal with intermittent periods of deep groundwater levels. Using this methodology disregards groundwater fluctuations and may result in the omission of ecosystems that are groundwater dependent.
- The presence or proximity of surface water, which does not necessarily prove that the plants and animals do not access groundwater. GDEs can simultaneously rely on multiple sources of water (i.e., both groundwater and surface water), or shift their reliance on different sources on an interannual or inter-seasonal basis.
- GDEs located next to net-losing streams were rejected. This selected removal criteria does not necessarily prove that the plants and animals do not access groundwater, as near losing reaches groundwater gradients are close enough to the surface to support ecological communities such as riparian vegetation. Analyzing groundwater levels is a more scientifically robust approach to validate the NC dataset, since GDEs are defined as 'ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface' [23 CCR § 350(m)].

<u>TNC recommendation</u>: TNC recommends that the GSA utilize groundwater levels that represent interannual and inter-seasonal variability along with additional information provided in our BMP guidance document (Attachment D) to identify and consider GDEs throughout the GSP. Specifically, the GSA should use a Digital Elevation Model (DEM) when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment D.

Water Budget – We were disappointed to see that the water budget did not include the current, historical and projected demands of native vegetation and managed wetlands, as required under SGMA (23 CCR §354.18(a) and (b)(3)). The GSP only focused on a subset of water use sectors, including urban and agricultural users of groundwater. Within these identified subsectors, we recommend water allocation that incentivizes and promotes demand management. The omission of beneficial environmental users is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget nor will they likely be considered in project and management actions.

<u>TNC recommendation</u>: As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget.

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[1] *Available at:* https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. As a result, the monitoring network does not adequately characterize GDEs and other environmental beneficial users of surface water and groundwater. Reference is made to a Proposition 68 funding request for addressing data gaps for shallow groundwater monitoring, however, potential well locations and the number of potential wells is not discussed anywhere in the GSP besides a single new monitoring well identified in the El Nido Area near the San Joaquin River. Therefore, GDEs and ISWs are not being specifically addressed by the monitoring network in the GSP.

TNC recommendation: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess potential impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but sustainable groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A
Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11
		If NC Dataset *was* used: Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12

<table>
<tr><td rowspan="12"></td><td rowspan="8"></td><td rowspan="2"></td><td>The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).</td><td>13</td></tr>
<tr><td>GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.</td><td>14</td></tr>
<tr><td>If NC Dataset was not used:</td><td>Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.</td><td>15</td></tr>
<tr><td colspan="2">Description of GDEs included:</td><td>16</td></tr>
<tr><td colspan="2">Historical and current groundwater conditions and variability are described in each GDE unit.</td><td>17</td></tr>
<tr><td colspan="2">Historical and current ecological conditions and variability are described in each GDE unit.</td><td>18</td></tr>
<tr><td colspan="2">Each GDE unit has been characterized as having high, moderate, or low ecological value.</td><td>19</td></tr>
<tr><td colspan="2">Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).</td><td>20</td></tr>
<tr><td rowspan="2">2.2.3
Water Budget
23 CCR §354.18</td><td colspan="2">Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.</td><td>21</td></tr>
<tr><td colspan="2">Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.</td><td>22</td></tr>
<tr><td rowspan="11">Sustainable Management Criteria</td><td rowspan="3">3.1
Sustainability Goal
23 CCR §354.24</td><td colspan="2">Environmental stakeholders/representatives were consulted.</td><td>23</td></tr>
<tr><td colspan="2">Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.</td><td>24</td></tr>
<tr><td colspan="2">Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.</td><td>25</td></tr>
<tr><td>3.2
Measurable Objectives
23 CCR §354.30</td><td colspan="2">Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.</td><td>26</td></tr>
<tr><td rowspan="3">3.3
Minimum Thresholds
23 CCR §354.28</td><td colspan="2">Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:</td><td>27</td></tr>
<tr><td colspan="2">Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?</td><td>28</td></tr>
<tr><td colspan="2">Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?</td><td>29</td></tr>
<tr><td rowspan="4">3.4
Undesirable Results
23 CCR §354.26</td><td colspan="2">For GDEs, hydrological data are compiled and synthesized for each GDE unit:</td><td>30</td></tr>
<tr><td rowspan="3">If hydrological data are available within/nearby the GDE</td><td>Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).</td><td>31</td></tr>
<tr><td>Baseline period in the hydrologic data is defined.</td><td>32</td></tr>
<tr><td>GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.</td><td>33</td></tr>
</table>

			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Merced Subbasin Groundwater Sustainability Plan

The Merced Subbasin GSP dated November 2019 was reviewed by TNC. TNC submitted comments on the Public Draft GSP on August 19, 2019. We reviewed the responses to comments and the text of the Final GSP to determine if changes were made to the Final GSP that addressed TNC's previously submitted comments. Changes have been made in selected sections of the main body of the GSP as well as in Appendix O, where all comments and responses are consolidated. In many cases, responses are provided in Appendix O but no changes to the main body of the GSP have been made. This is noted where appropriate. The GSA response to comments is also provided in Attachment F of this letter. This attachment lists our original comments on the complete Public Draft GSP, as submitted to the Merced Subbasin during the public comment period, and states whether or not they were addressed in the Final GSP *[as green text within brackets]*. Comments are provided in the order of the checklist items included as Attachment A.

Section 1.2.5 Beneficial Uses and Users p. 1-40
(Checklist Item 1)
[This comment was partly addressed. This section has been modified to note environmental interests as a subheading. The following NGOs are added to the list: Audubon California; East Merced Resource Conservation District / Sustainable Conservation; River Partners. No additional information is provided on the natural communities and no reference is made to the freshwater species list. Appendix O describes the stakeholder selection process in the region, but the identification of environmental stakeholders is not specifically described.] The environment is listed as one of the beneficial users of groundwater in the Subbasin, but few details are given. The US Fish and Wildlife is listed as operating several wildlife refuges supported by groundwater, as shown in Figure 1-7 (p. 1-20), along with state parks. A statement is made that there are other wetlands and GDEs that exist mostly in the western part of the subbasin, but they are not specified.

The types and locations of environmental uses, species and habitats supported, and the designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the Subbasin should be specified. To identify environmental users, **please refer to the following**:

- Natural Communities Commonly Associated with Groundwater dataset (NC Dataset) - https://gis.water.ca.gov/app/NCDatasetViewer/
- The list of freshwater species located in the Merced. Subbasin in **Attachment C** of this letter. Please take particular note of the species with protected status.
- Lands that are protected as open space preserves, habitat reserves, wildlife refuges, etc. or other lands protected in perpetuity and supported by groundwater or interconnected surface waters should be identified and acknowledged.

The stakeholder outreach process is described, and include outreach to federal, state, and local agencies, but did not appear to engage environmental groups. **Please note if any environmental groups were contacted and were enlisted in the GSP development process.**

<u>Section 1.2 Plan Areas p. 1-13 through 1-38</u>
<u>(Checklist Item 2)</u>

[This comment was partly addressed. This section has been modified to refer to a map of the surface water stations in Chapter 4. No reference is made to other plans, such as HCPs and NCCPs in the subbasin.] The jurisdictional boundaries and water use management and existing monitoring programs are adequately described. The land use designations do not show types of crops. Only federal and state parks are shown on Figure 1-7 (p. 1-20). The general and land use plans are adequately described. **Surface water gauging is described for the three major creeks; a map showing the locations would be helpful. Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin should be added and noted if they are associated with critical, GDE and/or ISW habitats.**

<u>Section 2.1.3.3 Surface Water p. 2-9 through 2-12</u>
<u>(Checklist Item 3)</u>

[This comment was partly addressed. A limited amount of information is provided, but there is no systematic summary of instream flow requirements in the different creeks, except the following statement on page 1-41: "Since 2000, Merced River releases by MID for the Vernalis Adaptive Management Plan to facilitate the migration of juvenile Chinook salmon have been approximately 60,000 AFY."] The regulation of surface waters by dams and reservoirs is described for each of the major rivers in Section 2.1.3.3 Surface Waters. Past examples of in-stream flows are given on page 1-40 for the Merced River, by the Merced Irrigation District. In-stream flow requirements in each of the rivers/streams including the amount, time of year when the flow minimum is specified, the duration, the freshwater fish species for which it applies, associated permits that set forth the requirements, and the regulating agency setting forth the compliance requirements. **Please provide a list of the current in-stream flow requirements for chinook salmon and other threatened and endangered fish species and other requirements to protect habitat on the Merced and San Joaquin Rivers and the other creeks.**

<u>Section 1.2.3.3 Well Permitting p.138</u>
<u>Checklist Item 4</u>

[No additional clarification is provided in the GSP.] Merced County established a well permitting system for new, replacement, back-up, and De Minimus wells in 2015. It is not clear if this requirement covers monitoring wells, unless they are classified as De Minimus wells. The permit includes property setback distances, which may apply to surface water. The City of Merced also enforces well standards that apply to all new and existing water wells, monitoring wells, cathodic protection wells, test wells and those exploratory holes deeper than twenty feet within the jurisdictional boundaries of the city. The City of Merced directs permittees to DWR standards for

wells. **Please clarify the permitting requirements for monitoring wells and how they will be coordinated with the GSP.**

Section 2.1.6.2 Bottom of the Merced Basin p. 2-39
(Checklist Item #5)

[This comment was addressed. This clarifying information is provided on page 2-43 of the Final GSP: "A well depth analysis completed in March 2018 found that, based on information in Merced County's well permit database, 56 wells (approximately 4% of wells with data) extended below the bottom of the basin as defined above, primarily located along the central portion of the County just east of the San Joaquin River (Woodard & Curran, 2018b). The quality of water produced from these wells is not known, and no data are available to show that the wells are actively used."] The base of freshwater, defined as specific conductance > 3,000 micromhos/cm, is used as the bottom of the basin. Because the depth varies with location, a map is provided as Figure 2-28 (p. 2-40). The depth of this boundary is provided in some areas of the geologic cross-sections, but not others. As noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the definition of the basin bottom.** This will prevent the possibility of extractors with wells deeper than the basin boundary (defined by the base of freshwater) from claiming exemption from SGMA due to a well residing outside the vertical extent of the basin boundary. **Please check that active wells used for domestic or public water supply or agricultural wells are not deeper than the base of freshwater.**

Section 2.2.1.2 Current Groundwater Conditions p. 2-63 through 2-29
(Checklist Item #6)

[No GSP changes made in this section.] The number of wells used to describe the groundwater elevations for each aquifer is sparse. For example, there were only eight wells used for the spring 2017 elevation measurements (Figure 2-44 p. 2-64) for the Above the Corcoran Clay aquifer and six for fall 2017 elevation for the Above the Corcoran Clay aquifer (Figure 2-47 p. 2-67). Additional wells have been included in the GSP Monitoring Program, as stated on p. 4-2, "The Merced Subbasin GSP groundwater level monitoring network totals 50 wells from the CASGEM program. This includes 13 wells in the Above Corcoran Clay Principal Aquifer, 16 wells in the Below Corcoran, and 21 wells in the Outside Corcoran. **Additional monitoring wells with appropriate screened intervals should be installed and added as the funding allows.**

Section 2.1.7.2 Principal Aquifers and Aquitards
(Checklist Item 6)

[No GSP changes made in this section.] The three principal aquifers have been combined from the original five designations. The three aquifers are shown in a schematic diagram (Figure 2-36 p. 52) and the general characteristics are discussed (p. 2-52 and 2-53). The shallow aquifers are not described in sufficient detail to show where GDEs are likely and the places with interconnected surface water. **Please expand the discussion of shallow groundwater and discuss any**

information regarding vertical groundwater gradients across the principal aquifers.

Section 2.1.4 Geologic Formations and Stratigraphy
(Checklist Item 7)

[No GSP changes made in this section.] The geologic cross-sections, Figures 2-13 through 2-17 and Figure 2-19 through 2-22 (p. 2-24 and 2-27 and 2-29 and 2-32, respectively), show the full depth of the basin and do not highlight the shallow aquifers. **Cross-sections along the San Joaquin and Merced Rivers showing the relationship between the rivers and the shallow aquifers would be helpful**. **The near-surface cross sections should provide details that depict the conceptual understanding of shallow groundwater and stream interactions at different locations, including perched aquifers**.

Section 2.2.6 Interconnected Surface Waters p. 108
(Checklist Items 8, 9 and 10)

[This comment was partly addressed. Documentation for the MercedWRM model is now presented in Appendix D. However, there is no information in this appendix to allow an evaluation of the gaining and losing streams. There is no calibration data reported on streamflows. Furthermore, the concept of "interconnected waters" is not referred to at all in the modeling report in Appendix D, although in other parts of the GSP it is stated that MercedWRM model is used to quantify interconnected surface waters.] A map showing gaining and losing streams was provided in Figure 2-9 (p. 2-15) as determined using the Merced Water Resources Model (MercedWRM). The report stated that no field studies had been conducted to confirm the designations and the documentation of the model was not provided in this report (Appendix D). Therefore, no estimates of surface water depletions by water year type were made. **Please provide the documentation for the model and how the gaining and losing streams were determined.**

Section 2.2.7 GDEs p. 2-109
(Checklist Item 10-15)

SGMA requires that all beneficial uses and users, including GDEs, be considered in the development and implementation of GSPs (Water Code §10723.2). The GSP Regulations include specific requirements to identify (map) GDEs and consider them when determining whether groundwater conditions are having potential effects on beneficial uses and users. SGMA also requires an assessment of whether sustainable management criteria (including minimum thresholds and measurable objectives) may cause adverse impacts to beneficial uses, including GDEs, and that monitoring networks are designed to detect such impacts. Therefore, mapping GDEs is a critical first step for incorporating environmental considerations into GSPs.

- It appears that the preliminary desktop analysis, completed by Woodard & Curran and documented in the draft GSP, resulted an excessive elimination of the NC dataset polygons mapped in the Merced Subbasin. In particular, the methods used to confirm whether or not polygons in the NC Dataset are connected to groundwater in the Merced Subbasin are highly flawed. Here we debunk the scientific insufficiencies in the methodology used:
    1. *Areas with depth to groundwater greater than 30 feet in Spring 2015.*

a. *[No changes to this section were made in response to above comment. The screening is still performed using Spring 2015 data. Furthermore, there is no change in the methodology used to identify and remove GDE areas from consideration. In Appendix O, it is stated that the methodology combined the NCCAG database with "additional local data and knowledge," but no further details are provided.]* While depth to groundwater levels within 30 feet are generally accepted as being a proxy for confirming that polygons in the NC dataset are connected to groundwater, it is highly advised that seasonal and interannual groundwater fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from <u>one point in time</u> (e.g., Spring 2015) can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Based on a study we recently submitted to Frontiers in Environmental Science Journal, we've observed riparian forests along the Cosumnes River to experience a range in groundwater levels between 1.5 and 75 feet over seasonal and interannual timescales. Seasonal fluctuations in the regional water table can support perched groundwater near an intermittent river that seasonally runs dry due to large seasonal fluctuations in the regional water table. While perched groundwater itself cannot directly be managed due to its position in the vadose zone, the water table position within the regional aquifer (via pumping rate restrictions, restricted pumping at certain depths, restricted pumping around GDEs, well density rules) and its interactions with surface water (e.g., timing and duration) can be managed to prevent adverse impacts to ecosystems due to changes in groundwater quality and quantity under SGMA. **We highly recommend using depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network.**
b. *[No additional clarification provided in Final GSP.]* **Please confirm that wells screened in the Shallow and Leaky intermittent principal aquifers located <u>above the Corocoran Clay Layer</u> are being used to verify whether NCCAGs are actual GDEs.** According to Figure 2-39, the majority of wells in the area in between Route 140, Route 59, and the San Joaquin River where NCCAGs were not identified as GDEs due to "depth to water" (Figure 2-86); however the wells located in this area are predominantly irrigation

and domestic wells screened in the principal aquifers BELOW the Corocoran Clay Layer. Using "depth to groundwater" measurements from confined aquifers is mapping piezometric head of the confined aquifer and not detecting groundwater conditions in the principal aquifers of the unconfined aquifer that are supporting the ecosystem. If there is insufficient groundwater level data in the principal aquifers above the Corocoran Clay layers, then the NCCAGs in these areas should be included as GDEs in the GSP until data gaps are reconciled in the monitoring network.

c. *[No additional detail provided on the depth calculation.]* Please provide more details on how depth to groundwater contour maps were developed:
    i. Are the wells used for interpolating depth to groundwater sufficiently close (<5km) to NC Dataset polygons to reflect local conditions relevant to ecosystems?
    ii. Are the wells used for interpolating depth to groundwater screened within the surficial unconfined aquifer and capable of measuring the true water table? (see comment b above)
    iii. Is depth to groundwater contoured using **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape? This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[2] to estimate depth-to-groundwater contours across the landscape. This will provide much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make. It is better to assume that water surface elevations are constant in between wells, and then calculate depth to groundwater using a DEM of the land surface to contour depth to groundwater.

d. *[No GSP changes made in response to this comment.]* Spring 2015 is after the SGMA benchmark date of January 1, 2015. **Please rely on groundwater condition data prior to the SGMA benchmark date.**

e. *[No GSP changes made in response to this comment.]* Please use care when considering rooting depths of vegetation. While Valley Oak (*Quercus lobata*) have been observed to have a max rooting depth of ~24 feet (https://groundwaterresourcehub.org/gde-tools/gde-rooting-depths-database-for-gdes/), rooting depths are likely to spatially vary based on the local hydrologic conditions

[2] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

available to the plant. Also, max rooting depths do not take capillary action into consideration, which will vary with soil type and is an important consideration since woody phreatophytes generally do not like to have their roots submerged in groundwater for extended periods of time, and hence can access groundwater at deeper depths. In addition, while it is likely to be true that shallow water availability is necessary to support the recruitment of saplings, hydraulic lift of groundwater to shallow depths has been observed in *Quercus* spp. Research on the symbiotic relationships between species and offspring is still emerging, but the assumption that a groundwater depth of 25 feet is "unlikely to support recruitment of new oak seedlings" is an unsubstantiated claim and falsely considered to be "conservative". This approach is not "conservative" and results in the elimination of more NC polygons because it negates the fact that there may be mature tree species that are likely connected to groundwater. Regardless of life stage, if any plant or animal species in the NC polygons are connected to groundwater, then it needs to be mapped as a GDE. The evaluation of potential effects on GDEs (e.g., the likelihood that regeneration is not occurring in the GDE due to groundwater levels being too deep for saplings) is to be performed when defining undesirable results in the Sustainable Management Criteria section of GSP, not the Basin Setting section.

2. *Habitat areas with supplemental water*
    a. *[No GSP changes made in response to this comment.]* The application of supplemental water to managed wetlands <u>does not preclude</u> the possibility that NC polygons could be accessing groundwater in addition to the supplied water. In the scientific literature, it is generally acknowledged that GDEs can rely on groundwater for <u>some or all</u> of its requirements. GDEs can rely on multiple water sources simultaneously and at different temporal/spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow). SGMA defines GDEs as "ecological communities and species that depend on groundwater <u>emerging from aquifers</u> or on groundwater <u>occurring near</u> the ground surface". Hence, **we recommend that depth to groundwater contour maps are used to identify whether a connection to groundwater exists for the Managed Wetlands in the Merced Subbasin. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.**
3. *Areas adjacent to irrigated fields*
    a. *[No GSP changes made in response to this comment.]* SGMA defines GDEs as "ecological communities and species that depend on

groundwater emerging from aquifers or on groundwater occurring near the ground surface". **We recommend that depth to groundwater contour maps are used to identify whether a connection to groundwater exists for the NC Dataset polygons adjacent to irrigated fields in the Merced Subbasin. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.**

b. *[No GSP changes made in response to this comment.]* GDEs can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields - simultaneously and at different temporal/spatial scales. Groundwater basins can be comprised of one continuous aquifer or multiple aquifers stacked on top of each other. Basins with a stacked series of aquifers may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow principal aquifers, that support springs, surface water, and groundwater dependent ecosystems. **NC polygons adjacent to irrigated land can still potentially be reliant on shallow groundwater aquifers, thus excluding them based on their proximity to irrigated fields is inadequate.**

4. *Areas depending on adjacent losing surface water bodies*

   a. *[No GSP changes made in response to this comment.]* While losing conditions occur when groundwater levels are lower than the stage in the stream, the degree to which losing conditions occur will depend on the groundwater level gradient between them. Losing conditions also vary in time, especially over different seasons. Even if a stream or river reach is losing, the riparian vegetation may still be accessing groundwater, and hence be identified as a GDE. **We highly recommend that depth to groundwater levels under the NC polygons be used as the evaluation criteria, since access to groundwater could be occurring in/near losing reaches. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.** If riparian vegetation in losing reaches are 100% of the time using surface water (especially if the groundwater is consistently deep), it is not a GDE.

   b. *[This comment was partly addressed. Although model documentation is provided, the graphical information is not sufficiently detailed to allow an independent assessment of the areas excluded.]* Areas within 300 feet of losing streams identified by the model, MERCEDWRM, were eliminated. The distance of 300 feet seems excessive and may have eliminated some areas prematurely. The documentation of the model was not included in the draft report, Appendix D, so this information could not be verified.

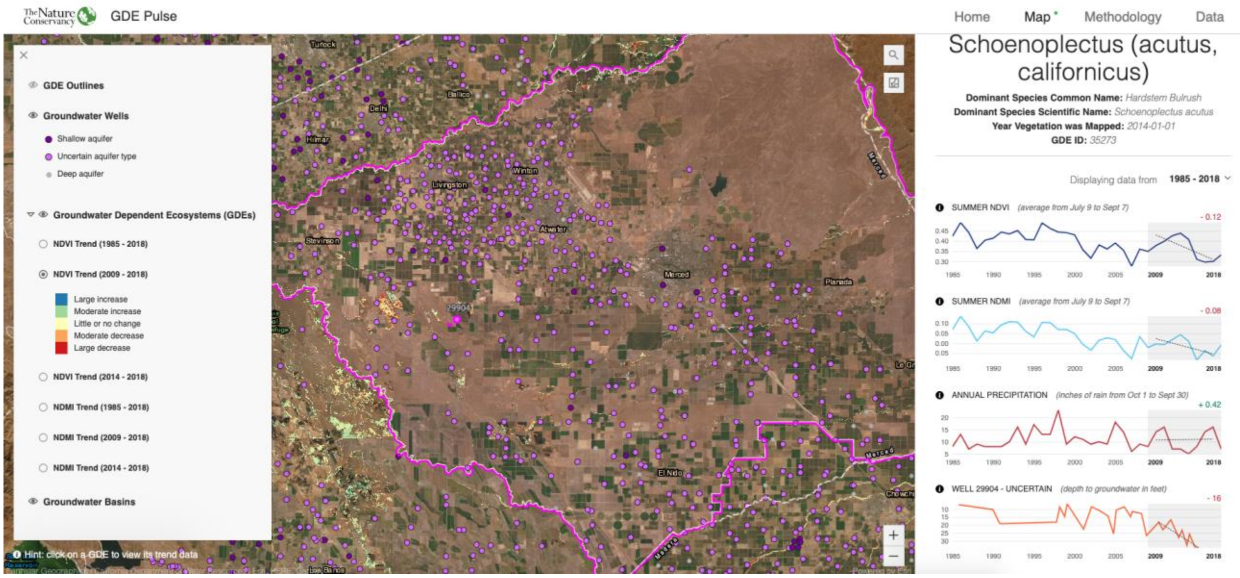
5. *Areas of vernal pool complexes*
    a. *[No GSP changes made in response to this comment.]* While we generally agree that vernal pools are shallow pockets of groundwater that are not directly connected or associated with principal aquifers, **please included a short description on whether or not the vernal pool complexes mapped in the DFW 1989-1998 dataset are consistent with information collected in the HCM and groundwater conditions in the surficial aquifers (e.g., shallow and intermittent leaky aquifers above the Corocoran Clay Layer).**

- *[These maps were not modified in the Final GSP.]* The NC dataset is a starting point for GSAs to identify GDEs in their basin. **Please map the original NC dataset on Figures 2-86, 2-87, and 2-88 (p. 2-111, 2-112, and 2-113) and document which polygons were added (and what local sources were used to identify them), removed (and the removal reason), and kept (from the original NC dataset). The basin's GDE shapefile, which is submitted via the SGMA Portal, should also include two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).**

Section 3.37 GDE p. 2-109 through 2-112

Checklist Items 16-20)

- *[This comment was not addressed in the Final GSP. No new information provided on historical and current conditions in the Final GSP, but this is identified as future work to be done during the preparation of the first Annual Report (Section 7.6).]* No information was given on the historical or current groundwater conditions in the GDEs or the ecological conditions present. **Please provide groundwater data for historical and current conditions near the GDEs or identify as a data gap. Refer to GDE Pulse (https://gde.codefornature.org; See Attachment E of this letter for more details) or any other locally available data to describe depth to groundwater trends in and around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI).** Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in Merced Subbasin:



- *[This comment was not addressed. No additional information is provided in the GSP, and no indication provided that this will be addressed in future work.]* The vegetation species were not ranked as having a high, moderate or low value and no inventory of the vegetation types or habitat types were provided. **Please identify whether any endangered or threatened freshwater species of animals and plants or areas with critical habitat were found in any of the GDEs.** The list of freshwater species located in the Merced Subbasin in **Attachment C** of this letter.

<u>Section 2.3 Water Budget Information p. 2-113</u>
<u>(Checklist Item 21-22)</u>

[This comment was partly addressed. Additional documentation was provided on the water budget as part of the model documentation in Appendix D.] The water budget for the surface water components did not include an explicit evapotranspiration term, but the following footnote was included as an explanation to Table 2-14 (p. 2-121 to 2-122). "Other flows is a closure term that captures the stream and canal system include gains and losses not directly measured or simulated within IWFM. Some of these features include but may not be limited to direct precipitation, evaporation, unmeasured riparian diversions and return flow, temporary storage in local lakes and regulating reservoirs, and inflow discrepancies resulting from simulating impaired flows." Riparian uptake from streams and evapotranspiration was included in the Land System Budget Table 2-15 (p. 2-123 to 2-124). The groundwater budget (Table 2-16 p. 2-125 and 2-126) did not include an explicit evapotranspiration term but included the following footnote "Other flows within the groundwater system including temporary storage in the vadose zone, and root water uptake from the aquifer system." The water budgets were calculated by the model, MercedWRM, and without the documentation the water budget is uncertain. **Please provide a more complete description of the budget and the full model documentation in Appendix D.**

Section 3.1 Sustainability Goal p, 3-1
(checklist Items 23-25)

[This comment was not addressed. No change made in response to this comment in the main body of the GSP. This is also not identified nor addressed as a comment or response in Appendix O.] The sustainability goal is stated as "Achieve sustainable groundwater management on a long-term average basis by increasing recharge and / or reducing groundwater pumping, while avoiding undesirable results" (p. 3-1). The report does not provide details on stakeholders involved in the goal selection process. The statement refers to "undesirable results" but does not mention GDEs, specifically. The goal appears to be directed toward reducing the groundwater overdraft and reducing the chance of wells going dry. The goal does not make a distinction between the pre-SGMA period and later years. **Please clarify the sustainability goal and expand it to pertain to protection of GDE, ISWs and critical habitats.**

Section 3.3.3 Measurable Objectives and Interim Milestones p, 3-4
(Checklist Item 26)

[No GSP changes made in response to this comment.] The measurable objectives addressed only the representative monitoring wells and was set at 25 feet above the minimum threshold. GDEs were not considered. **Please expand the Measurable Objectives to include protection of the environmental health of GDEs and ISWs.**

Section 3.3.2 Minimum Thresholds p. 3-4
(Checklist Item 27-29)

[No GSP changes made in response to this comment.] The minimum threshold was set at each of the representative monitoring wells. The level was defined as "The minimum threshold for groundwater levels was defined as the construction depth of the shallowest domestic well within a 2-mile radius." p. 3-5
Thus, GDEs were not considered. **Please explain whether any adverse impacts to GDEs are expected and if changes to the minimum threshold should be made.**

[No GSP changes made in response to this comment.] Chronic lowering of groundwater was considered by proxy only for the Merced River and San Joaquin River, not for the other creeks in the Merced Subbasin. **Please identify areas on rivers or creeks where depletions are expected and if the minimum threshold should be changed.**

Section 3.3.1 Undesirable Results p. 3-3
(Checklist Items (30-46)

- *[No GSP changes made in response to this comment.]* Undesirable results are defined as follows: "For the Merced Subbasin, an undesirable result for declining groundwater levels is considered to occur during GSP implementation when November groundwater levels at greater than 25% of representative monitoring wells (at least 7 of 25) fall below their minimum thresholds for two consecutive years where both years are categorized hydrologically as below normal, above normal, or wet" (p.3-3). GDEs are not specifically addressed. No hydrologic or biological data are compiled for the GDEs and data gaps are not described. Potential impacts on the GDEs are not described. **For existing GDEs, please provide hydrologic and biological data for current conditions and describe how susceptible they are to future impacts.**

- *[No specific GSP change made in response to this comment, although the use of the GDE Pulse is noted in Chapter 7 in the context of developing future annual reports.]* **Please provide more specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs.** The definition of 'significant and unreasonable' is a qualitative statement that is used to describe when undesirable results would occur in the basin, such that a minimum threshold can be quantified. Potential effects on all beneficial users of groundwater in the basin need to be taken into consideration. According to the California Constitution Article X, §2, water resources in California must be "put to beneficial use to the fullest extent of which they are capable". **Please identify appropriate biological indicators that can be used to monitor potential impacts to environmental beneficial users due to groundwater conditions. Refer to Appendix E of this letter for an overview of a free, new online tool for monitoring the health of GDEs over time.**

Section 4.5.6 Data Gaps p. 4-13
(Checklist Item #47)

[See note below on additional monitoring well construction.] Three regions where monitoring wells are missing or scarce are shown in Figure 4-6 (p. 4-14). These areas include:

> "1. Data Gap #1: Located northwest of Merced and northeast of Atwater, this area contains relatively fewer existing wells, which often have limited construction information, and the wells are generally privately owned and require coordination with well owners to obtain permission and data.
> 2. Data Gap #2: Located along the western edge of the Subbasin, this area has virtually no known wells; overall well coverage needs to be enhanced through outreach to well owners to identify wells that can be used for monitoring purposes.
> 3. Data Gap #3: Located along the southern portion of the Subbasin just east of Data Gap #2, there are known potential wells to monitor but acquiring data from these wells is associated with technical or funding issues. These wells are primarily located within a federal wildlife refuge."

Aside from these areas, there are limited wells close to the Merced and San Joaquin Rivers to track conditions near potential GDEs. **Greater effort should be directed toward obtaining full well construction information in all areas, but especially in the areas with GDEs and then selecting appropriate wells for monitoring.**

Section 4.10 Depletions of Interconnected Surface Water Monitoring Network p, 4-30
(Checklist Item 48)

[This comment was partly addressed, and indirectly in an appendix; it would be better to make the change in the main body of the GSP. Currently, Appendix O

provides the following update on shallow groundwater monitoring: "Shallow groundwater monitoring, particularly in the El Nido area and near the San Joaquin River, is identified as a critical data gap in the GSP. The GSP implementation section has been revised to indicate that new monitoring well sites in areas near likely GDEs should include a very shallow well at the same location, to the extent funding and logistics allow. The GSAs are also requesting additional funding from the state to aid in addressing data gaps through a grant program established by the California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access for All Act of 2018 (Proposition 68). A multi-level monitoring well is already planned for installation at the fire station in El Nido as a result of Sustainable Groundwater Planning Grant Program Round 2 funding by the Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1)."] The stream gauges used to support interconnected stream monitoring are listed in Table 4-10 and shown in Figure 4-9 (p. 4-32 and 4-33, respectively). The GSP states on page 4-35 that "The understanding of depletions of interconnected surface water could be improved through additional depth-discrete groundwater elevation data near some rivers and streams and some NCCAGs." **The addition of clusters of multi-depth wells near the known interconnected surface waters should be given a high priority.**

Section 4.1 Monitoring Network Objectives p, 4-1
(Checklist Item 49)

[No change made in response to this comment in the GSP, although the use of the GDE Pulse tool is referred to for future Annual Reports.] One of the stated objectives of the monitoring program is "Monitoring impacts to the beneficial uses or users of groundwater." (p. 4-1) There is no reference to use of biological data for monitoring potential impacts to the GDEs or to the combined use of hydrologic and biological data. Hydrologic and biological data should be obtained around existing GDEs. Remote imaging can provide a useful tool for monitoring ecosystem health of GDEs and ISWs. **Please clarify the potential use of imagery as a monitoring tool and expand it to monitoring surface indicators of ISW and GDE ecosystem health. Please describe how GDEs will be monitored to avoid or minimize impacts from both a hydrologic and biological standpoint.**

Section 6.3 Projects p. 6.6
(Checklist Item #50-51)

[No change made in the GSP in response to this comment. In Appendix O it is stated that "The existing prioritization criteria was intended to encompass and is consistent with the suggested revision of prioritization description. This change to the text would not alter the results of current or future project prioritization."] A process was conducted by the three GSAs and stakeholders to select 12 projects. The projects are listed in Table 6-3. Only a general way of evaluating each project is given. Up to 50 future potential projects, listed in Table 6-6 Projects Running List for Reference, and may be implemented as priorities and funding change. None of the 12 selected projects are expected to directly benefit GDEs. **Please explain how the groundwater recharge projects (Project #1, #4, and #10) could benefit GDEs or a location near the GDEs and how the projects will be evaluated.**

Attachment C

Freshwater Species Located in the Merced Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Merced Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[3]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[4] as well as on The Nature Conservancy's science website[5].

Scientific Name	mmon Name	Legally Protected Species		
		Federal	State	Other
Birds				
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority

[3] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[4] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[5] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
Crustaceans				
Branchinecta conservatio	Conservancy Fairy Shrimp	Endangered	Special	IUCN - Endangered
Branchinecta lindahli	Versatile Fairy Shrimp			
Branchinecta longiantenna	Longhorn Fairy Shrimp	Endangered	Special	IUCN - Endangered
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Branchinecta mesovallensis	Midvalley Fairy Shrimp		Special	
Cyzicus californicus	California Clam Shrimp			
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
Fishes				
Mylopharodon conocephalus	Hardhead		Special Concern	Near-Threatened - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Acipenser transmontanus	White sturgeon		Special	Vulnerable - Moyle 2013

Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Cottus asper ssp. 1	Prickly sculpin			Least Concern - Moyle 2013
Cottus gulosus	Riffle sculpin		Special	Near-Threatened - Moyle 2013
Entosphenus tridentata ssp. 1	Pacific lamprey		Special	Near-Threatened - Moyle 2013
Gasterosteus aculeatus microcephalus	Inland threespine stickleback		Special	Least Concern - Moyle 2013
Lampetra hubbsi	Kern brook lamprey		Special Concern	Vulnerable - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		Special	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		Special Concern	Near-Threatened - Moyle 2013
Mylopharodon conocephalus	Hardhead		Special Concern	Near-Threatened - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus tshawytscha - CV fall	Central Valley fall Chinook salmon	Species of Special Concern	Special Concern	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV late fall	Central Valley late fall Chinook salmon	Species of Special Concern		Endangered - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Pogonichthys macrolepidotus	Sacramento splittail		Special Concern	Vulnerable - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
Herps				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Pseudacris regilla	Northern Pacific Chorus Frog			
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC

Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
Insects and Other Invertebrates				
Ablabesmyia spp.	Ablabesmyia spp.			
Berosus spp.	Berosus spp.			
Centroptilum spp.	Centroptilum spp.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Enallagma carunculatum	Tule Bluet			
Microtendipes spp.	Microtendipes spp.			
Mideopsis spp.	Mideopsis spp.			
Nanocladius spp.	Nanocladius spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Psychodidae fam.	Psychodidae fam.			
Sigara spp.	Sigara spp.			
Stylurus olivaceus	Olive Clubtail			
Tanytarsus spp.	Tanytarsus spp.			
Trichocorixa spp.	Trichocorixa spp.			
Mammals				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
Mollusks				
Anodonta californiensis	California Floater		Special	
Ferrissia spp.	Ferrissia spp.			
Helisoma anceps	Two-ridge Rams-horn			CS
Margaritifera falcata	Western Pearlshell		Special	
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			

Plants				
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Arundo donax	NA			
Azolla filiculoides	NA			
Bacopa eisenii	Gila River Water-hyssop			
Bacopa rotundifolia	NA			
Brodiaea nana				Not on any status lists
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Castilleja campestris succulenta	Fleshy Owl's-clover	Threatened	Endangered	CRPR - 1B.2
Cephalanthus occidentalis	Common Buttonbush			
Cicendia quadrangularis	Oregon Microcala			
Crassula aquatica	Water Pygmyweed			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus squarrosus	Awned Cyperus			
Damasonium californicum				Not on any status lists
Downingia bella	Hoover's Downingia			
Downingia cuspidata	Toothed Calicoflower			
Downingia pulchella	Flat-face Downingia			
Downingia pusilla	Dwarf Downingia		Special	CRPR - 2B.2
Elatine brachysperma	Shortseed Waterwort			
Elatine californica	California Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis quadrangulata	NA			
Elodea canadensis	Broad Waterweed			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium castrense	Great Valley Eryngo			
Eryngium racemosum	Delta Coyote-thistle		Endangered	CRPR - 1B.1
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle		Special	CRPR - 1B.2

Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Gratiola ebracteata	Bractless Hedge-hyssop			
Gratiola heterosepala	Boggs Lake Hedge-hyssop		Endangered	CRPR - 1B.2
Hydrocotyle ranunculoides	Floating Marsh-pennywort			
Isoetes howellii	NA			
Isoetes nuttallii	NA			
Isoetes orcuttii	NA			
Juncus exiguus				Not on any status lists
Juncus uncialis	Inch-high Rush			
Juncus usitatus	NA			Not on any status lists
Lasthenia ferrisiae	Ferris' Goldfields		Special	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Lemna gibba	Inflated Duckweed			
Lemna minuta	Least Duckweed			
Limnanthes douglasii nivea	Douglas' Meadowfoam			
Limnanthes douglasii rosea	Douglas' Meadowfoam			
Ludwigia peploides peploides	NA			Not on any status lists
Lycopus americanus	American Bugleweed			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Mimulus latidens	Broad-tooth Monkeyflower			
Mimulus tricolor	Tricolor Monkeyflower			
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Myriophyllum aquaticum	NA			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Navarretia myersii myersii	Pincushion Navarretia		Special	CRPR - 1B.1
Navarretia prostrata	Prostrate Navarretia		Special	CRPR - 1B.1
Neostapfia colusana	Colusa Grass	Threatened	Endangered	CRPR - 1B.1

Orcuttia inaequalis	San Joaquin Valley Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Orcuttia pilosa	Hairy Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Panicum dichotomiflorum	NA			
Paspalum distichum	Joint Paspalum			
Persicaria amphibia				Not on any status lists
Persicaria hydropiper	NA			Not on any status lists
Persicaria hydropiperoides				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys austiniae	Austin's Popcorn-flower			
Plagiobothrys distantiflorus	California Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plagiobothrys undulatus	NA			Not on any status lists
Plantago elongata elongata	Slender Plantain			
Pogogyne douglasii	NA			
Pogogyne zizyphoroides				Not on any status lists
Potamogeton nodosus	Longleaf Pondweed			
Potamogeton pusillus pusillus	Slender Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Psilocarphus tenellus	NA			
Ranunculus aquatilis aquatilis	White Water Buttercup			
Ranunculus bonariensis	NA			
Ranunculus sceleratus	NA			

Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rorippa palustris palustris	Bog Yellowcress			
Rumex stenophyllus	NA			
Sagittaria sanfordii	Sanford's Arrowhead		Special	CRPR - 1B.2
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus californicus	California Bulrush			
Sidalcea calycosa calycosa	Annual Checker-mallow			
Sidalcea hirsuta	Hairy Checker-mallow			
Sparganium eurycarpum eurycarpum				
Spirodela polyrhiza	NA			
Stachys albens	White-stem Hedge-nettle			
Stuckenia striata				Not on any status lists
Triglochin scilloides	NA			Not on any status lists
Tuctoria greenei	Green's Awnless Orcutt Grass	Endangered	Rare	CRPR - 1B.1
Typha domingensis	Southern Cattail			
Zannichellia palustris	Horned Pondweed			

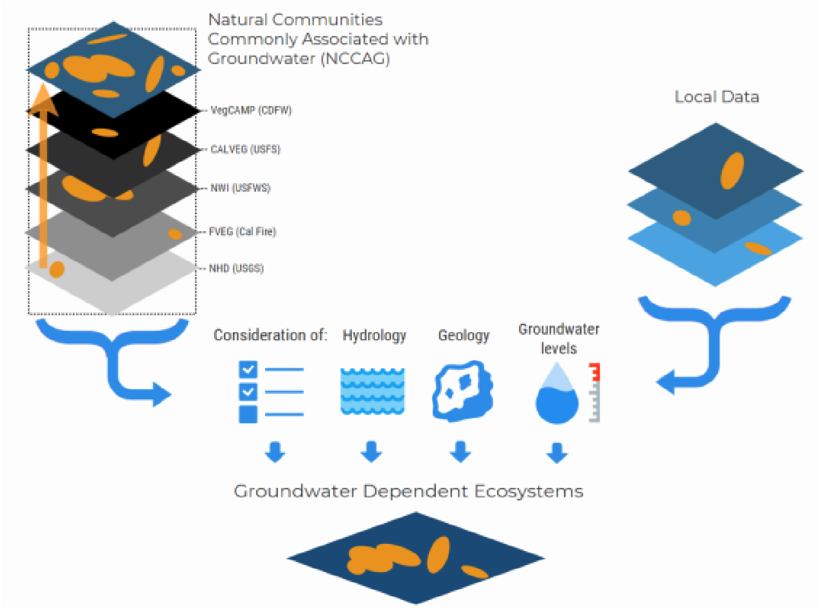
Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[6] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[7]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48

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[6] *NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/*

[7] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[8]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[9] on the Groundwater Resource Hub[10], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[8] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[9] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[10] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

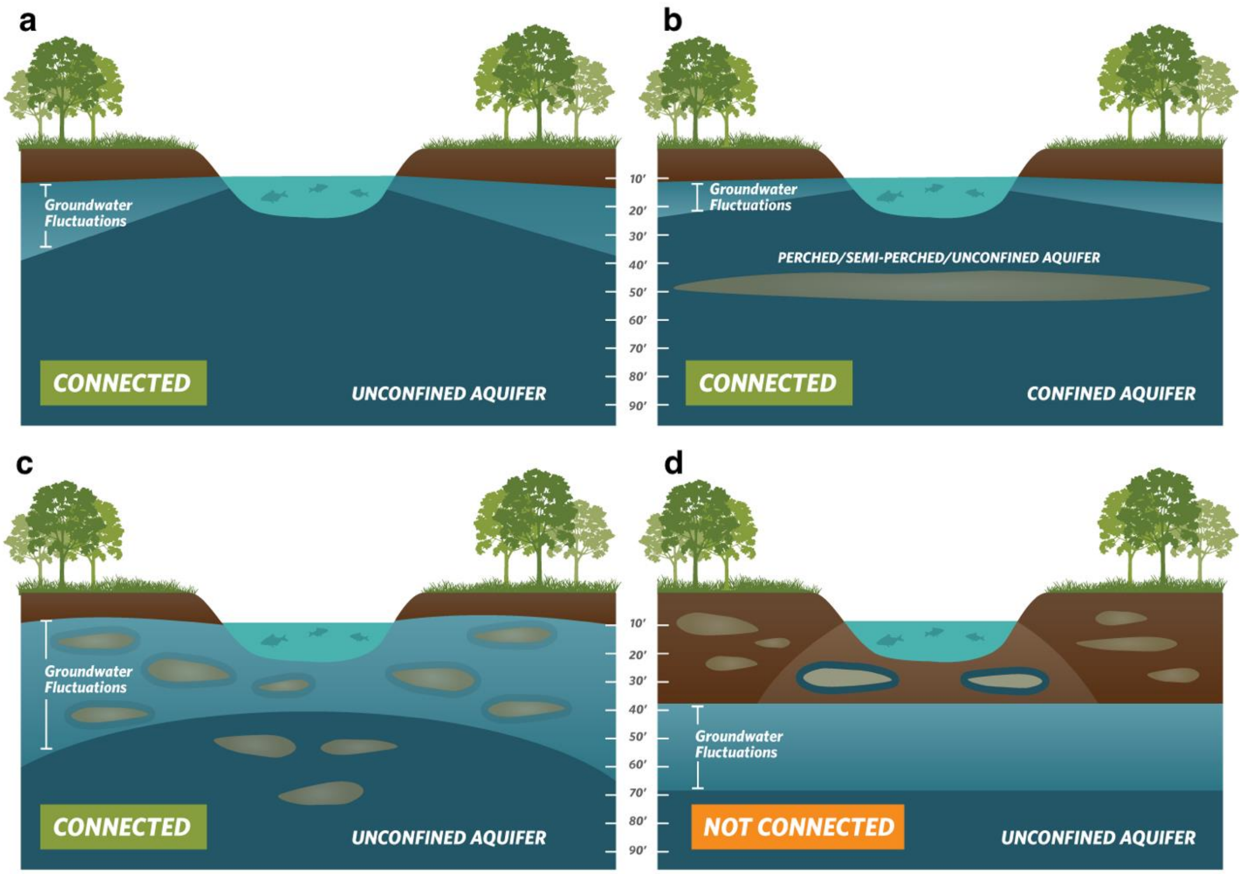

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[11] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[12] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[13] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[14]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network (see Best Practice #6).

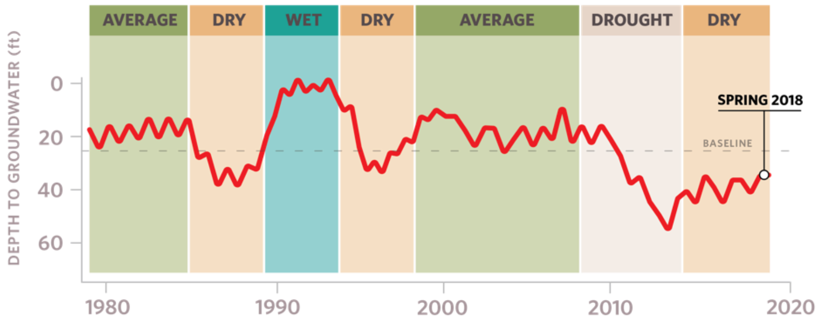

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[11] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[12] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[13] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[14] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[15], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

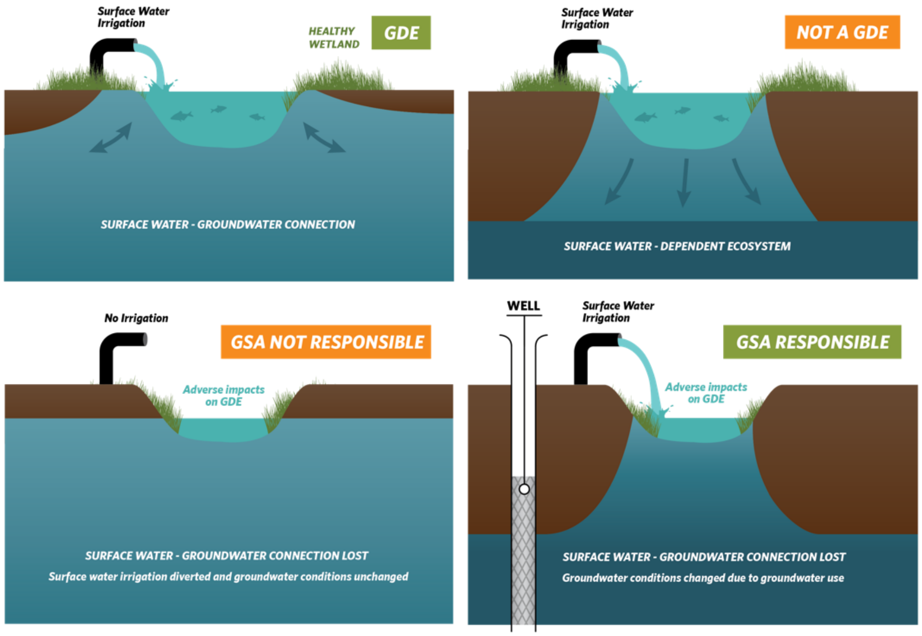

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[15] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

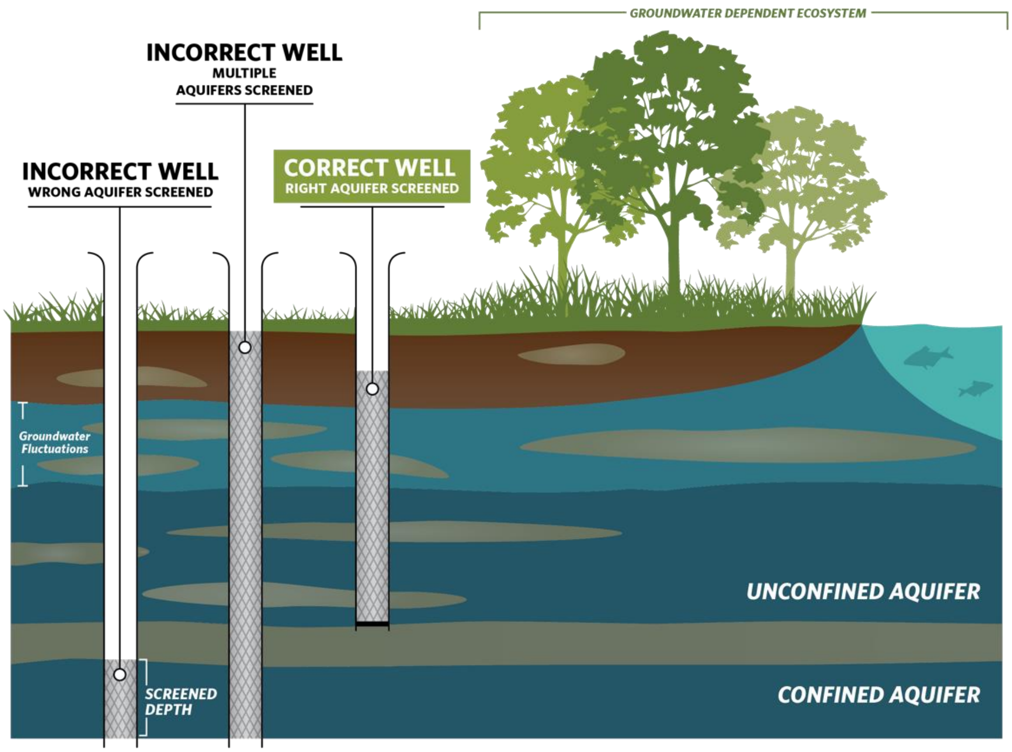

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[16] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

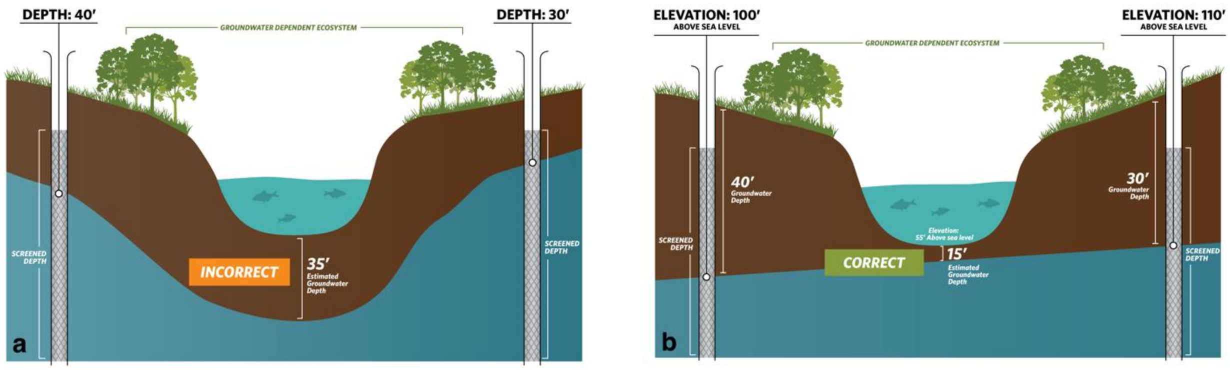

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

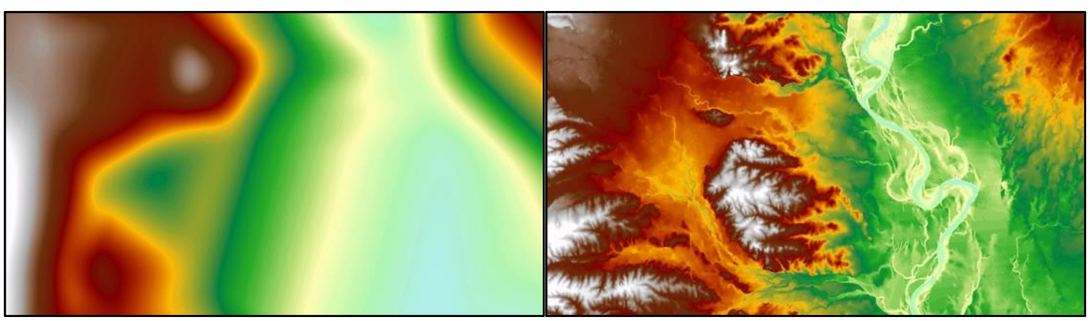

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

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[16] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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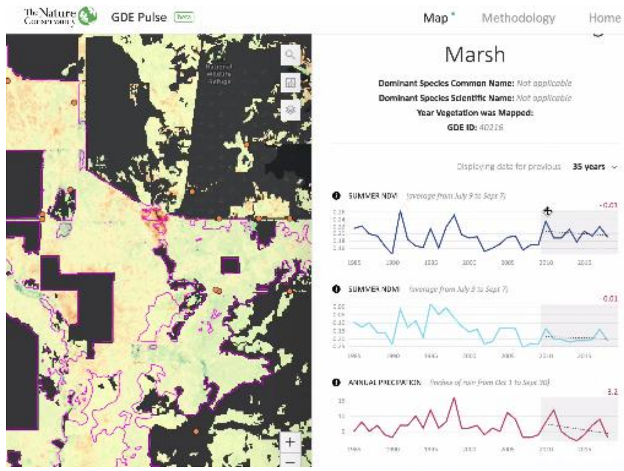
Visit https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[17]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[18]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

[17] *The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#*

[18] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F

The GSA Response to TNC Comments on the Draft GSP is located on DWR's SGMA portal as Part 2 of 2 of TNC Comments.

Attachment G

Mapping Likely Interconnected Surface Water
The Nature Conservancy, California, May 2020

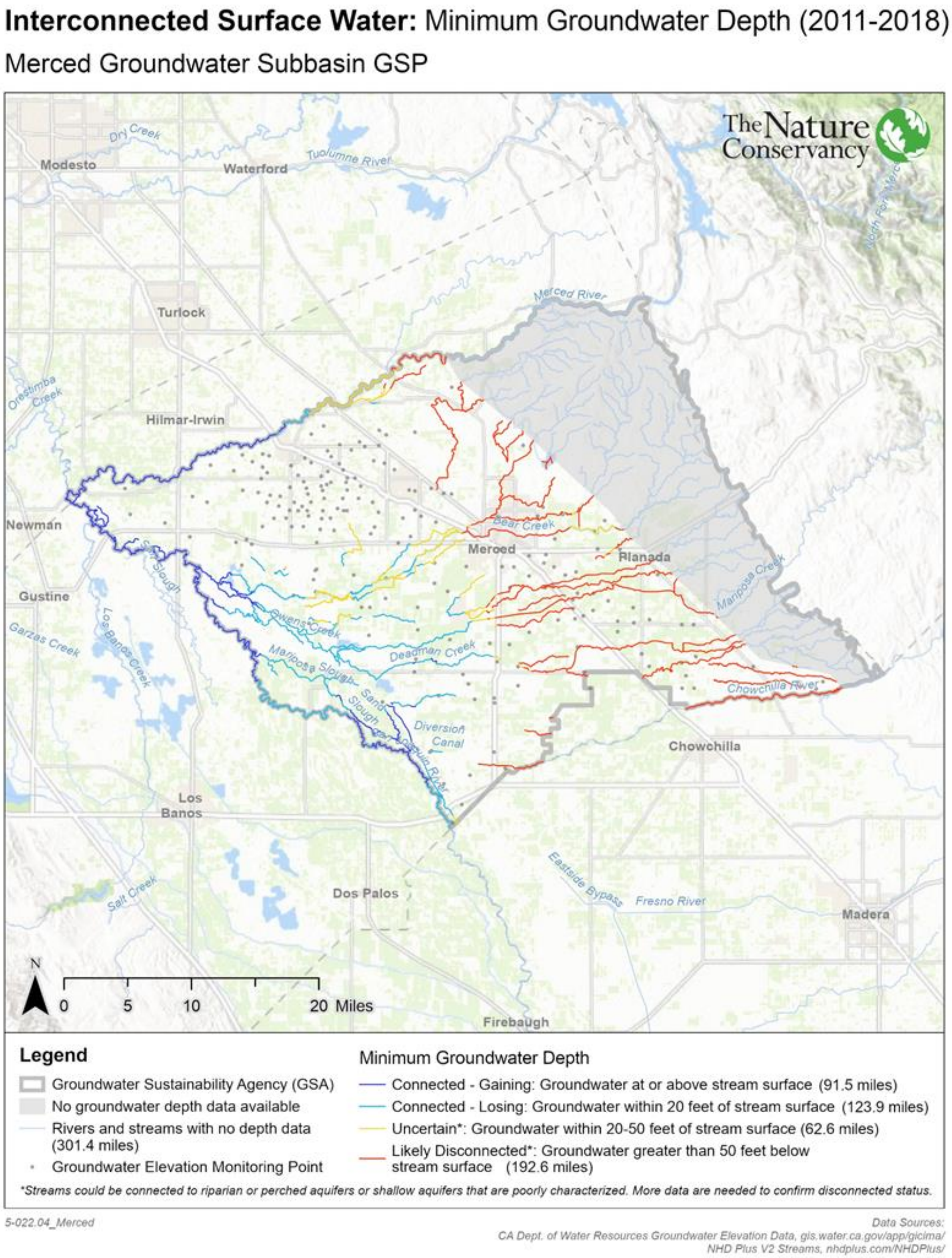
Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, ISW is defined as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:
The groundwater elevation data, available for Spring 2011-2012, and Spring and Fall 2013-2018, comes from the California Department of Water Resources (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). These data are represented as continuous raster layers that approximates "feet above or below mean sea level" based on groundwater well measurements. According to the documentation online, groundwater level measurements were selected based on measurement date and well construction information (where available) and are intended to approximate the groundwater levels in the unconfined to uppermost semi-confined aquifers. Each of the raster layer has a different extent, but all of them are limited to the Central Valley. To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

The map splits groundwater depth into four categories:

- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.
- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.



TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[19]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[20]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[21] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[19] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[20] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[21] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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June 3, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Mid-Kaweah Groundwater Sustainability Plan (GSP), Kaweah Subbasin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Mid-Kaweah Groundwater Sustainability Agency's (GSA's) Mid-Kaweah Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing sustainable groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be insufficient in addressing environmental beneficial uses and users.

The identification of environmental beneficial users, as well as their consideration when establishing the sustainability goal, undesirable results, minimum thresholds and measurable objectives were unreasonable (23 CCR §355.4(b)(4)) and lacked best available science (23 CCR §355.4(b)(1)). In the face of existing, severe overdraft, the GSP would allow groundwater management to largely ignore potential impacts to environmental beneficial users. This could result in irreparable harm to these beneficial users, undermining the intent of SGMA to achieve sustainability.

Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address gaps within 180 days. In these cases, we strongly recommend that the Department set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update. Should the treatment of environmental beneficial users be indicative of the quality of the overall plan, then we recommend the Department deem the plan inadequate.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides the GSA's response to TNC's comments on the Draft GSP.

<u>Our Key Considerations</u>

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We are disappointed to see the feedback that we provided on the draft GSP has been ignored in the final plan, as only 2 out of 38 of our comments were adequately addressed in the Final GSP. This indicates poor engagement of environmental beneficial users, which undermines the intent of SGMA to ensure that sustainability be defined locally with the participation of all users. Based on our experience the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan" (23 CCR §355.4(b)(10)).

<u>TNC recommendation</u>: We strongly recommend that DWR require the GSA to prioritize stakeholder engagement through improvements to their stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters (ISWs) – The GSP incorrectly ignored potential and/or actual ISWs because the plan did not employ the best available science. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). ISWs were not adequately analyzed in the GSP. The GSP provides a narrative description of surface water reaches in the Kaweah subbasin, but does not attempt to specify or map interconnected reaches or estimate the quantity and timing of streamflow depletions. Therefore, potential ISWs may not be managed in the GSP.

<u>TNC recommendation</u>: Until a disconnection can be proven, TNC recommends that the GSP include all potential and confirmed ISWs. We recommend that the GSA conduct a thorough analysis of existing data on surface water-groundwater interconnectivity and estimate the quantity and timing of streamflow depletions in the subbasin. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 220 acres of potential GDEs occur in the GSA boundary. TNC developed the *Groundwater Dependent Ecosystems under*

SGMA: Guidance for Preparing GSPs[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

The plan does not adequately identify, map and consider GDEs. We believe that this does not meet plan evaluation criteria (1), (4) and (10), as defined in the 23 CCR §355.4(b). In addition, the Plan does not satisfy the requirement to identify GDEs (23 CCR §Section 354.16(g)) and consider beneficial users throughout the plan. Our review found that NC Dataset polygons were improperly removed from the GDE map based on groundwater levels that were greater than 50 feet at a single point in time. While we appreciate the use of a more conservative groundwater depth threshold, this is a technically problematic approach since groundwater levels fluctuate over seasonal and interannual time scales due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Justifying the removal of NC dataset polygons solely based on this criterion does not acknowledge that groundwater levels temporally vary and the fact that many plant species within GDEs have adapted water stress strategies to deal with intermittent periods of deep groundwater levels. Using this methodology disregards groundwater fluctuations and can leave many GDEs unidentified and unprotected in the GSP.

TNC recommendation: TNC recommends that the GSA utilize groundwater levels that represent interannual and inter-seasonal variability along with additional information provided in Attachment D on best practices for utilizing the NC dataset to identify and consider GDEs throughout the GSP. Specifically, the GSA should use a Digital Elevation Model (DEM) when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment D.

Water Budget – We would like to commend the GSP for including the groundwater demands of phreatophytes in the historical, current and projected water budgets. As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget. Please clarify if other categories of native vegetation and managed wetlands were included in the water budget, and include them if omitted.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and/or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to

[1] *Available at:* https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

calculate the depletions of surface water caused by groundwater extractions. As a result, the monitoring network does not adequately characterize GDEs and other environmental beneficial users of surface water and groundwater. Potential GDEs are located in areas of the subbasin where no shallow groundwater monitoring currently exists or is proposed, leaving data gaps unfilled. Potential ISWs have been dismissed in the GSP, without proposed recommendations to improve ISW identification, mapping, and depletion estimates. Therefore, GDEs and ISWs are not being specifically addressed by the monitoring network in the GSP.

TNC recommendation: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but sustainable groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Mid-Kaweah Groundwater Sustainability Plan

A complete draft of the Mid-Kaweah Groundwater Sustainability Plan (GSP) was provided for public review on July 31, 2019; TNC submitted comments on the Draft GSP on September 9, 2019. Public draft GSP comments and responses, provided as Attachment D of the GSP, were reviewed and are referred to below. The GSP comments and responses are also provided in Attachment F of this letter. We reviewed the responses to comments and the text of the Final GSP (dated December 18, 2019) to determine if changes were made to the Final GSP that addressed TNC's previously submitted comments. This attachment lists our original comments on the complete Public Draft GSP, and states whether or not they were addressed in the Final GSP *[as green text within brackets]*. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

- [Section 1.5.2 Beneficial Uses and Users (p. 1-23 to 1-25)]
  - *[No GSP text changes were made in response to our comment.]* Surface water users and the following groups were listed as Beneficial Users: "Environmental and ecosystem interests in MKGSA include representatives of the Tulare Basin Wildlife Partners, Sierra Club Mineral King Group, and Sequoia Riverlands Trust (p. 1-25)." **Please identify whether or not the following beneficial uses and users of groundwater in the subbasin are present: Protected Lands, including preserves, refuges, conservation areas, recreational areas; and other protected lands; and Public Trust Uses, including wildlife, aquatic habitat, fisheries, and recreation.**
  - *[No GSP text changes were made in response to our comment.]* The types and locations of environmental uses, species and habitats supported, and the designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the Subbasin should be specified. **To identify environmental users, please refer to the following:**
    - Natural Communities Commonly Associated with Groundwater dataset (NC Dataset) - https://gis.water.ca.gov/app/NCDatasetViewer/
    - The list of freshwater species located in the Kaweah Subbasin in Attachment C of this letter. Please take particular note of the species with protected status.

Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8).

- [Section 1.4.3 General Plans in Plan Area (p. 1-12 to 1-16)]

- *[No GSP text changes were made in response to our comment.]* This section should include a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals, rather than being limited to goals and policies directly related to groundwater resources as the Tulare General Plan does. **Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs.**
- *[No GSP text changes were made in response to our comment.]* This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin and if they are associated with critical, GDE or ISW habitats. **Please identify all relevant HCPs and NCCPs within the Subbasin, and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.**
- *[No GSP text changes were made in response to our comment.]* The Open Space and Conservation Element of the City of Visalia's General Plan includes (p. 1-14 to 1-15):

  "1. Protect, restore and enhance a continuous corridor of native riparian vegetation along Planning Area waterways, including the St. Johns River; Mill, Packwood, and Cameron Creeks; and segments of other creeks and ditches where feasible, in conformance with the Parks and Open Space diagram of this General Plan.

  2. Establish design and development standards for new projects in waterway corridors to preserve and enhance irrigation capabilities, if provided, and the natural riparian environment along these corridors. In certain locations or where conditions require it, alternative designs may be appropriate (e.g., terraced seating or a planted wall system)

  3. Place special emphasis on the protection and enhancement of the St. Johns River Corridor by establishing extensive open space land along both sides

  4. Where no urban development exists, maintain a minimum riparian habitat development setback from the discernible top of the bank: 50 feet for both sides of the Mill, Packwood, and Cameron Creek corridors and 25 feet for both sides of Modoc, Persian, and Mill Creek ditches. Where riparian trees are located within 100 feet of the discernible top of the banks of the creek corridors and 50 feet from the banks for the ditches, the setback shall be wide enough to include five feet outside the drip line of such trees. Restore and enhance the area within the setback with native vegetation as follows:

     a. Where existing development or land committed to development prohibits the 50-foot setback on Mill, Packwood, and Cameron Creek corridors, provide the maximum amount of land available for a development setback

     b. Where existing development or land committed to development prohibits the 25-foot setback along Modoc, Persian, and Mill Creek ditches, provide the maximum amount of land available for a development setback."

  Please specify if any of these areas are potential GDEs and describe how they are managed.

- *[No GSP text changes were made in response to our comment.]* Please refer to the Critical Species Lookbook[2] to review and discuss the potential groundwater reliance of critical species in the basin. **Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.**

- *[No GSP text changes were made in response to our comment.]* [Appendix 2A Section 2.3.1 Existing Groundwater Level Monitoring (p. 37-38)] The monitoring programs are described, but there is no mention of how GDEs are monitored and protected. **Once GDEs are identified, please describe how existing groundwater monitoring programs are protective of GDEs, or propose additional monitoring that specifically targets GDEs.**
- *[No GSP text changes were made in response to our comment.]* [Appendix 2A Section 2.3.4 Existing Stream Flow Monitoring (p. 50)] This section describes the programs of USACOE, Kaweah and St. Johns Rivers Association (KSJRA), and the ditch companies. Surface water sources are listed along with the group monitoring them. Small surface streams which pass through TID's service area are noted as used, but the names are not listed. There is no mention of ISWs or GDEs and how they are monitored. **Please explain how existing stream flow monitoring is protective of ISWs and GDEs.**
- *[No GSP text changes were made in response to our comment.]* [Section 1.4.4 Well Permitting Process (p. 1-17)] **This section should include a discussion of the following:**
    - Future well permitting must be coordinated with the GSP to assure achievement of the Plan's sustainability goals. The County of Tulare is currently revising their well permitting program. The City of Visalia also has a well permitting program for wells within their jurisdiction.
    - The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF v. SWRCB and Siskiyou County, No. C083239). The need for well permitting programs to comply with this requirement should be stated in the text.

Checklist Items 5, 6, and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14); The Hydrogeologic Conceptual Model should illustrate the relationship between GDEs, surface waters, and principal aquifers.

- *[No GSP text changes were made in response to our comment.]* [Appendix 2A Section 2.2.4 Bottom of the Subbasin (p. 22)] The base of the Subbasin corresponds with the base of freshwater. "This is generally defined as the elevation below which total dissolved solids are greater than 2,000 milligrams per liter (mg/l) (Bertoldi et al, 1991)" (p. 22 of Appendix 2A). As noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP

[2] *The Critical Species LookBook is available at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/*

(https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** Properly defining the bottom of the basin will prevent the possibility of extractors with wells deeper than the basin boundary from claiming exemption from SGMA due to their well residing outside the vertical extent of the basin boundary.

- *[No GSP text changes were made in response to our comment.]* [Appendix 2A Section 2.2.1.3 Kaweah Subbasin Geology (p. 17-21)] Basin-wide cross sections provided in Figures 4 through 13 are regional, and do not include a graphical representation of the manner in which shallow groundwater may interact with ISWs or GDEs that would allow the reader to understand this topic. **Please consider including an example near-surface cross section that depicts the conceptual understanding of shallow groundwater and stream interactions at different locations, including the Upper Aquifer, as well as any potential GDEs**.

Checklist Items 8, 9, and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16); Identification of ISWs is a required element of Current and Historical Groundwater Conditions (23 CCR §354.16).

- *[No GSP text changes were made in response to our comment.]* [Appendix 2A Section 2.9 Interconnected Surface Water (p. 145)] The discussion of interconnected surface waters should first be introduced in Appendix 2A Section 2.4 (Groundwater Elevation and Flow Conditions §354.16), since the identification of interconnected surface water systems is a required element of Current and Historical Groundwater Conditions (23 CCR §354.16). In Appendix 2A Section 2.4 (Groundwater Elevation and Flow Conditions §354.16), please expand this discussion, in particular:
    - The regulations [23 CCR §351(o)] define interconnected surface waters (ISW) as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. **Please identify interconnected surface waters in the Basin by relying on groundwater elevation and stream gauge data, specifying any data gaps that exist so that they can be resolved in the monitoring network.**
    - ISWs are best estimated by first determining which reaches are completely disconnected from groundwater. This approach would involve comparing groundwater elevations with a land surface Digital Elevation Model that could identify which surface waters have groundwater consistently below surface water features, such that an unsaturated zone would separate surface water from groundwater. Groundwater elevations that are always deeper than 50 feet below the land surface can be used to identify the aboveground reaches as disconnected surface waters. **Please reconcile data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells) along**

surface water features in the Monitoring Network section of the GSP to improve ISW mapping.

- *[No GSP text changes were made in response to our comment.]* [Section 3.2.1.5 Interconnected Surface Water Systems (p. 3-4)] "Depletions of interconnected surface waters are minimal and, to the extent they occur, impact only vegetation along the banks of unlined channels within the forebay regions of the aquifer system where natural channels exhibit gaining reaches from time to time. Undesirable results may occur should any such groundwater-dependent vegetation disappear from locations of known historic existence." This discussion is inadequate and is not supported by data. **Please expand the discussion of ISWs to include the above referenced recommendations on identifying and mapping ISWs and provide discussion of the depletions on specific rivers or creeks.**

Checklist Items 11 to 15, Identifying and Mapping GDEs (23 CCR §354.16); Identification of GDEs is a required element of Current and Historical Groundwater Conditions (23 CCR §354.16).

- *[No GSP text changes were made in response to our comment.]* [Section 5.3.5 Minimum Thresholds – Interconnected Surface Waters (p. 5-17)], [Appendix 2A Section 2.2.7.3 Delineation of recharge areas, potential recharge areas, and discharge areas, including springs, seeps, and wetlands (p. 33)], and [Appendix 2A Section 2.10 Groundwater Dependent Ecosystems (p. 146)] All three of the above referenced sections refer to or include discussion of the identification of groundwater dependent ecosystems (GDEs). **Please consolidate and expand these sections of the document in GSP Appendix 2A Section 2.4 (Groundwater Elevation and Flow Conditions §354.16), since the identification of groundwater dependent ecosystems (GDEs) is a required element of Current and Historical Groundwater Conditions (23 CCR §354.16)**. This is a more appropriate place for the identification of GDEs, since groundwater conditions (e.g., depth to groundwater, interconnected surface water maps, groundwater quality) are necessary local information and data from the GSP in assessing whether polygons in the NC dataset are connected to groundwater in a principal aquifer. For detailed guidance on how to address GDEs, please see our publication, *GDEs under SGMA: Guidance for Preparing GSPs*[3]. In particular, note the following:
    - *[No GSP text changes were made in response to our comment.]* **Please provide a comprehensive discussion and figure(s) for the identification of GDEs**. Figure 19 of Appendix 2A is titled "Potential Groundwater Dependent Ecosystems", however the figure does not actually present this. The NC dataset is a starting point for GSAs to identify GDEs in their basin. The NC dataset comprises 3,488 acres of potential GDEs for the entire Kaweah basin, representing a significant amount of GDEs to be considered. **Please map the original NC dataset on Figure 19 or another figure, and document which polygons were added (and what**

[3]GDEs under SGMA: Guidance for Preparing GSPs is available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

local sources were used to identify them), removed (and the removal reason), and kept (from the original NC dataset). The basin's GDE shapefile, which is submitted via the SGMA Portal, should also include two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were added or removed).

- *[No GSP text changes were made in response to our comment.]* **Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network**. Specifically, please note:
  - *[Our comment was addressed. We thank the GSA for providing an updated map for depth to groundwater in response to the comment below, Figure 2-2 of Final GSP.]* **Please provide depth to groundwater contour maps. See Attachment D for best practices for completing this step. Specifically, ensure that the first step is contouring groundwater elevations, and the subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth to groundwater contours across the landscape**. This will provide much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make.
  - *[No GSP text changes were made in response to our comment.]* Figure 19 presents areas marked as 'Spring 2015 Groundwater Surface within 50 feet of Ground Surface'. Spring 2015 is after the SGMA benchmark date of January 1, 2015. **Please rely on groundwater condition data prior to the SGMA benchmark date**.
  - *[No GSP text changes were made in response to our comment.]* It is highly advised that seasonal and interannual groundwater fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one point in time (e.g., Spring 2015) can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. **We highly recommend using depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If insufficient data are available to**

describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network.

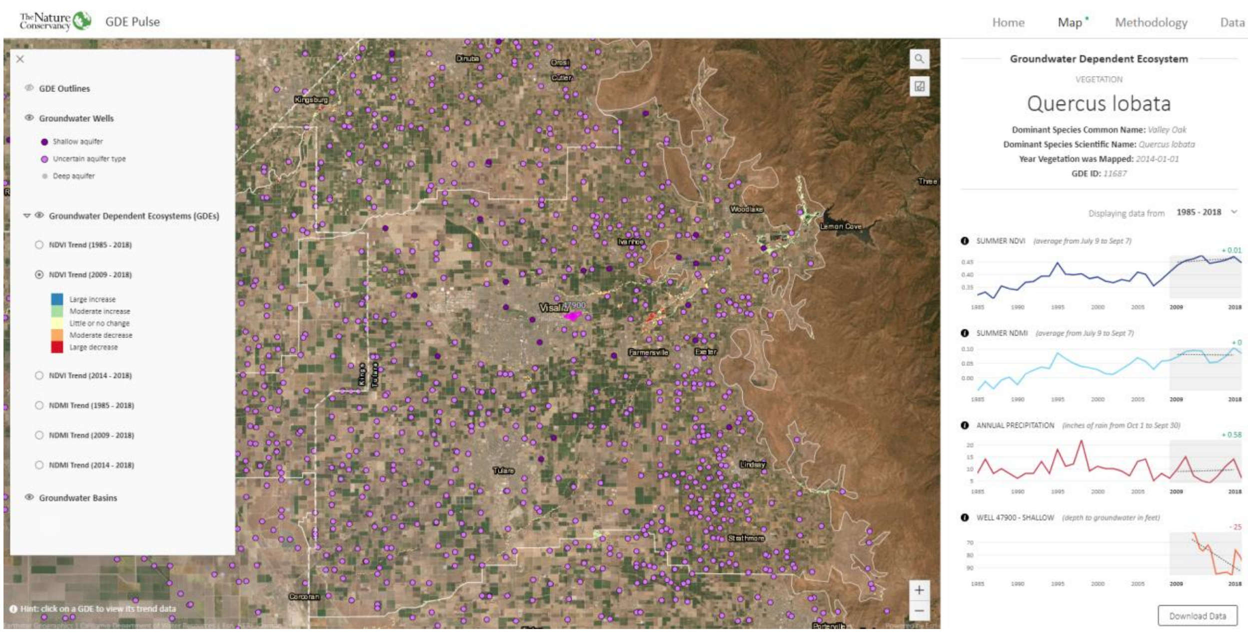
- *[No GSP text changes were made in response to our comment.]* **Please specify which data were used to determine the elevation of the stream or river bottom and the Valley Oak root zone in the basin**. Page 5-18 states "The water table lies some 60 to 150 feet below the invert of all three of these channel reaches, which is generally 40 to 130 feet below the root zone of the Valley Oak", however no information is provided on the data used to determine the elevation of the stream or river bottom and these calculations. These depths suggest a root zone of approximately 20 feet, but this is not stated explicitly. There is a citation to data (Lewis and Burgy, 1964[4]) which indicates root zones deeper than 70 feet for this species in a fractured rock aquifer. Rooting depths for the Valley Oak in this region have not been reported, and are a data gap. Furthermore, care must be taken when considering rooting depths of vegetation. Rooting depths are likely to spatially vary based on the local hydrologic conditions available to the plant. Maximum rooting depths do not take capillary action into consideration, which will vary with soil type and is an important consideration since woody phreatophytes generally do not like to have their roots submerged in groundwater for extended periods of time, and hence can access groundwater at deeper depths. In addition, while it is likely to be true that shallow water availability is necessary to support the recruitment of saplings, hydraulic lift of groundwater to shallow depths has been observed in Quercus spp.
- *[No GSP text changes were made in response to our comment.]* Page 33 of Appendix 2A states "The locations of these potential GDEs and hydrographs for the Subbasin indicate that the vegetation of these areas are dependent surface water flows, rather than shallow groundwater." We disagree with this statement dismissing all potential GDEs from further consideration. There are 3,488 acres of potential GDEs within the Kaweah subbasin as per the NC dataset, and the location is, as to be expected, at the interconnection between groundwater and surface water. Adverse impacts can occur to GDEs due to pumping that further separates groundwater from surface water. **Please provide the rationale for this statement, including the discussion of the type of river reach (i.e., gaining or losing)**. Riparian vegetation may still be accessing groundwater, and hence be identified as a GDE. We highly recommend that depth to groundwater levels under the NC polygons be used as the evaluation criteria, since access to groundwater could be occuring in/near losing reaches. **Please refer to Attachment D of this letter for best**

[4] *Lewis, D.C. and Burgy, R.H., 1964. The relationship between oak tree roots and groundwater in fractured rock as determined by tritium tracing. Journal of Geophysical Research, 69(12), pp.2579-2588.*

practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Specifically, it is highly advised that fluctuations in the groundwater regime be characterized in space and time to understand the seasonal and interannual groundwater variability in GDEs.

Checklist Items 16 to 20, Describing GDEs (23 CCR §354.16)

- *[No GSP text changes were made in response to our comment.]* **Once potential GDEs are identified, please provide information on the historical or current groundwater conditions in the GDEs or the ecological conditions present**. Refer to GDE Pulse (https://gde.codefornature.org; See Attachment E of this letter for more details) or any other locally available data to describe depth to groundwater trends in and around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in the Mid-Kaweah Subbasin:



- *[No GSP text changes were made in response to our comment.]* Once potential GDEs are identified, provide an inventory of the vegetation types or habitat types and rank the vegetation species as having a high, moderate or low value. **Please identify whether any endangered or threatened freshwater species of animals and plants or areas with critical habitat were found in any of the GDEs**. The list of freshwater species located in the Kaweah Subbasin can be found in Attachment C of this letter.

Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)

- [Appendix 2A Section 2.5.1.3 Summary of Water Budget Components (p. 102)]
    - *[Our comment was addressed. We appreciate that phreatophyte extraction is defined in the final GSP. This element was added to the water budget, and it is noted that this is a minor component of the water budget. This is presented in Table 30 (p. 102) of Appendix 2A.]* Please clarify what the term "phreatophyte extraction' means. The text states 'Phreatophyte extraction consists of removing vegetation in riparian areas to prevent consumptive water use." If phreatophytes were indeed removed from within the Subbasin, please provide further details. If phreatophyte extraction refers to the uptake of groundwater by phreatophytes, then correct this text. It should be clearly stated if the phreatophytes are referring to GDE vegetation (riparian vegetation).
    - *[No GSP text changes were made in response to our comment.]* **Please clarify what assumptions and data were used to calculate the outflow term from groundwater by phreatophytes.**

Checklist Items 23 to 25 – Sustainability Goal (23 CCR §354.24)

- *[No GSP text changes were made in response to our comment.]* [Section 3.1 Sustainability Goal (p. 3-2)] "The broadly stated sustainability goal for the Kaweah Subbasin as agreed to by the three GSAs therein is, for each GSA to manage groundwater resources to preserve the quality of life through maintaining the viability of existing enterprises of the region, both agricultural and urban." There is no mention of protection of ISWs or GDEs, and no indication that environmental stakeholders were consulted. **Please expand the goal to include protection of GDEs, ISWs, and critical habitats.**
- *[No GSP text changes were made in response to our comment.]* [Section 3.2.1.5 Interconnected Surface Waters (p. 3-4)] The statement "Depletion of interconnected surface waters are minimal and, to the extent they occur, impact only vegetation along the banks of unlined channels within the forebay regions of the aquifer system…." is not backed up by evidence presented in the GSP. **Once ISWs are analyzed per our comments on Checklist Items 8, 9, and 10 above, please revise this section, noting any data gaps to be filled.**

Checklist Item 26 – Measurable Objectives (23 CCR §354.30)

- *[No GSP text changes were made in response to our comment.]* [Section 5.4.1 Groundwater Level Measurable Objectives (p. 5-18 to 5-20)] The measurable objective was set equal to the water level at 2030 using the 2006-2016 water level trend for each of the wells selected as representative monitoring sites. The specific measurable objectives for all of the selected wells are listed in Table 5-3. **Please explain how the measurable objectives will help achieve the sustainability goal as it pertains to the environment. After GDEs and ISWs are identified,**

please discuss if any impacts to GDEs or ISWs are expected. Data gaps should be noted and addressed in the Monitoring section.

Checklist Items 27 to 29 – Minimum Thresholds (23 CCR §354.28)

- *[No GSP text changes were made in response to our comment.]* [Section 5.3.1 Minimum Thresholds – Chronic Lowering of Groundwater Levels (p. 5-1 to 5-9)] The trend of the 2006-2016 water levels over time was used to set the minimum threshold at 2040 for each of the wells, used as representative monitoring sites, in each of four hydrogeologic zones within the Subbasin (shown on Figure 5.1, p. A5-1). The minimum thresholds and other sustainable criteria for each well are listed in Table 5-3 (p. 5-5). The minimum threshold derived in this manner means that it is based on a pre-SGMA level. **After GDEs are identified, please add discussion of the possible impacts to the environment. Data gaps should be noted and addressed in the Monitoring section.**

Checklist Items 30 to 46 – Undesirable Results (23 CCR §354.26)

- *[No GSP text changes were made in response to our comment.]* [Section 3.2.2.5 Interconnected Surface Waters (p. 3-7)] **Please specifically cite "periodic comparisons of surface water elevations and flowrate depletion in applicable stream channels and adjacent groundwater" as a data gap and further address in the monitoring section.**
- *[No GSP text changes were made in response to our comment.]* [Section 3.2.3.5 Interconnected Surface Waters (p. 3-9)] As noted above, an inventory of the vegetation types or habitat types and ranking of the vegetation species as having a high, moderate or low value will provide rational for the statement that "the intermittent nature of this vegetative habitat is such that its temporary loss does not rise to the level of an undesirable result."
- *[No GSP text changes were made in response to our comment.]* [Section 5.3.1.2 Undesirable Results (p. 5-2)] After the identification and evaluation of potential GDEs is completed, this section should discuss impacts to those GDEs. Specifically,
    - For chronic lowering of water level, the GSP Committee considered that one-third of the representative monitoring sites (wells) exceeding minimum thresholds for water levels would constitute an undesirable result. There appears to be no additional guidance to protect potential GDEs or ISWs. **Please discuss how this undesirable result can be used to avoid impacts to GDEs or ISWs.**
    - There appears to be no consideration of undesirable results on land uses that include and consider recreational uses (e.g. fishing/hunting, hiking, boating) and property interests that include and consider privately and publicly protected conservation lands and open spaces, including wildlife refuges, parks and natural preserves. **Please describe how impacts to these types of properties will be avoided.**
    - **Please provide more specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize**

a significant and unreasonable impact to GDEs. The definition of 'significant and unreasonable' is a qualitative statement that is used to describe when undesirable results would occur in the basin, such that a minimum threshold can be quantified. Potential effects on all beneficial users of groundwater in the basin need to be taken into consideration. According to the California Constitution Article X, §2, water resources in California must be "put to beneficial use to the fullest extent of which they are capable". **Please identify appropriate biological indicators that can be used to monitor potential impacts to environmental beneficial users due to groundwater conditions. Refer to Appendix E of this letter for an overview of a free, new online tool for monitoring the health of GDEs over time.**

Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)

- [Section 4.4 Groundwater Level Monitoring Network (p.4-6 to 4-11)]
  - *[No GSP text changes were made in response to our comment.]* The GSP proposes to use groundwater level monitoring for chronic groundwater level. Some of the monitoring wells are missing well construction information (only 22 of 37 wells are complete). Only 14 of the 37 wells are screened in the Upper Aquifer. The missing well information is a known data gap and was acknowledged on p. 4-15. Two multi-level wells are proposed to help fill this data gap, shown on Figure 4-7 (p. 4-22). **The missing information should be obtained or a different well selected for monitoring.**
  - *[No GSP text changes were made in response to our comment.]* "As stated previously, the interconnection of surface water and groundwater was disrupted many decades ago in the MKGSA. Therefore, a monitoring network and monitoring is not required for this GSA (p. 4-14)." Data has not been presented to substantiate this statement. **Please provide additional analysis to back-up this conclusion.**
  - *[No GSP text changes were made in response to our comment.]* Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater *and related surface conditions* (emphasis added). Groundwater level monitoring alone may be insufficient to establish a linkage between groundwater extraction and potentially resulting impacts to environmental resources associated with GDEs and ISWs. The cause-effect relationship between groundwater levels and the biological responses that could result in significant and unreasonable impacts to ISWs and GDEs depends on a number of complicated factors, and this relationship is not characterized or discussed. As such, it is not possible to determine whether the proposed monitoring, minimum thresholds and measurable objectives are sufficiently protective to ensure significant and unreasonable impacts to GDEs and ISWs will be prevented. **Please add monitoring of potential GDEs and at any locations where ISWs have been or were previously present.**

- *[No GSP text changes were made in response to our comment.]* [Section 8.1 Annual Reporting Summary to DWR (p. 8-1 to 8-2)] "Groundwater contour maps submitted during the first five years may reflect a composite of the principal aquifers within the subbasin due to data gaps as discussed in Section 2 of this Plan. As additional dedicated monitoring wells are installed, and as more knowledge is gained regarding subbasin hydrogeology, groundwater conditions within each separate aquifer will be better understood (p. 8-1)." **A groundwater elevation map should be prepared for the Upper Aquifer above the Corcoran Clay**, as that is the only way one can determine the appropriate depth relationships between the surface water and the groundwater, which are needed to designate a GDE. Mixing shallow and deep wells, particularly when confined conditions may be present, can be misleading.

Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)

- [Section 7 Projects and Management Actions (p. 7-1)] A summary of projects and management actions are listed on p. 7-1 and described in the following pages (p. 7-2 through 7-30).
  - *[No GSP text changes were made in response to our comment.]* Most of the proposed projects involve recharge to groundwater. "Visalia Eastside Regional Park & Groundwater Recharge project to be built by the City of Visalia consists of a 250-acre park featuring diverse recreational opportunities, native plants, wildlife habitat, and integrated groundwater replacement and storm water retention facilities (p. 7-26)." This is an example of a project with environmental benefits and multiple other benefits. Consistent with existing grant and funding guidelines for SGMA-related work, priority should be given to multi-benefit projects that can address water quantity as well as providing environmental benefits or benefits to disadvantaged communities. **Please state how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.**
  - *[No GSP text changes were made in response to our comment.]* Recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such facilities have been incorporated into local HCPs, more fully recognizing the value of the habitat that they provide and the species they support. For projects that will be constructing recharge ponds, **please identify if there will be habitat value incorporated into the design and how the recharge ponds will be managed to benefit environmental users.**

Attachment C

Freshwater Species Located in the Kaweah Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Kaweah Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[5]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[6] as well as on The Nature Conservancy's science website[7].

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Birds				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			

[5] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[6] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[7] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			

Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
Crustaceans				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Fishes				
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Cottus gulosus	Riffle sculpin		Special	Near-Threatened - Moyle 2013
Lampetra hubbsi	Kern brook lamprey		Special Concern	Vulnerable - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		Special	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		Special Concern	Near-Threatened - Moyle 2013
Mylopharodon conocephalus	Hardhead		Special Concern	Near-Threatened - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013

Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
Herps				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis sirtalis sirtalis	Common Gartersnake			
Insects and Other Invertebrates				
Eulimnichus analis				Not on any status lists
Ischnura barberi	Desert Forktail			
Mammals				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
Mollusks				
Physella virgata	Protean Physa			CS
Plants				
Alnus rhombifolia	White Alder			
Ammannia coccinea	Scarlet Ammannia			
Anemopsis californica	Yerba Mansa			
Azolla filiculoides	NA			
Baccharis glutinosa	NA			Not on any status lists
Bidens laevis	Smooth Bur-marigold			
Carex densa	Dense Sedge			
Cephalanthus occidentalis	Common Buttonbush			
Cyperus acuminatus	Short-point Flatsedge			

Cyperus erythrorhizos	Red-root Flatsedge			
Downingia bella	Hoover's Downingia			
Echinodorus berteroi	Upright Burhead			
Eleocharis macrostachya	Creeping Spikerush			
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium pinnatisectum	Tuolumne Coyote-thistle		Special	CRPR - 1B.2
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle		Special	CRPR - 1B.2
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Lasthenia ferrisiae	Ferris' Goldfields		Special	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lemna minor	Lesser Duckweed			
Ludwigia peploides peploides	NA			Not on any status lists
Marsilea vestita vestita	NA			Not on any status lists
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus guttatus	Common Large Monkeyflower			
Mimulus tricolor	Tricolor Monkeyflower			
Myosurus minimus	NA			
Myriophyllum hippuroides	Western Water-milfoil			
Orcuttia inaequalis	San Joaquin Valley Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Paspalum distichum	Joint Paspalum			
Phyla nodiflora	Common Frog-fruit			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Platanus racemosa	California Sycamore			
Puccinellia simplex	Little Alkali Grass			
Rumex occidentalis				Not on any status lists
Sagina saginoides	Arctic Pearlwort			
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			

Stachys albens	White-stem Hedge-nettle			
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			

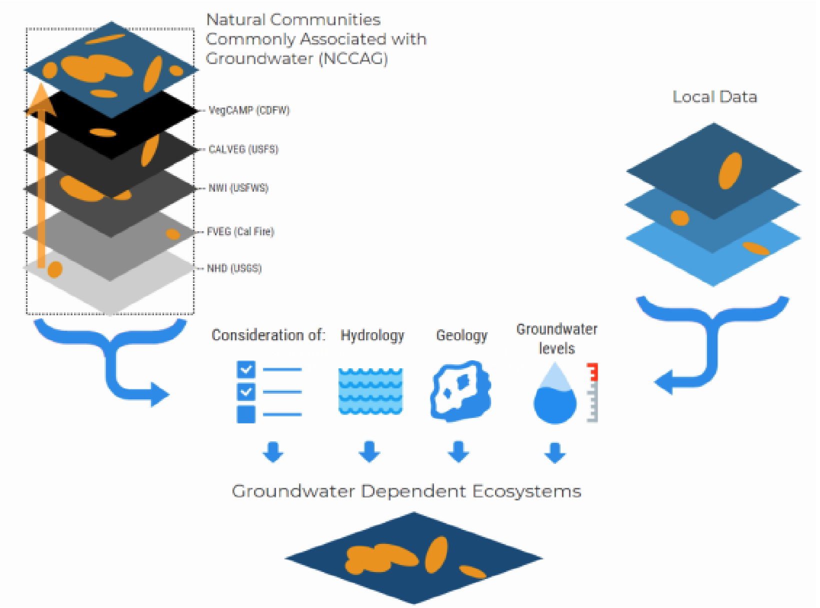
Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[8] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[9]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48

[8] *NC Dataset Online Viewer:* *https://gis.water.ca.gov/app/NCDatasetViewer/*

[9] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[10]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[11] on the Groundwater Resource Hub[12], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[10] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[11] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[12] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

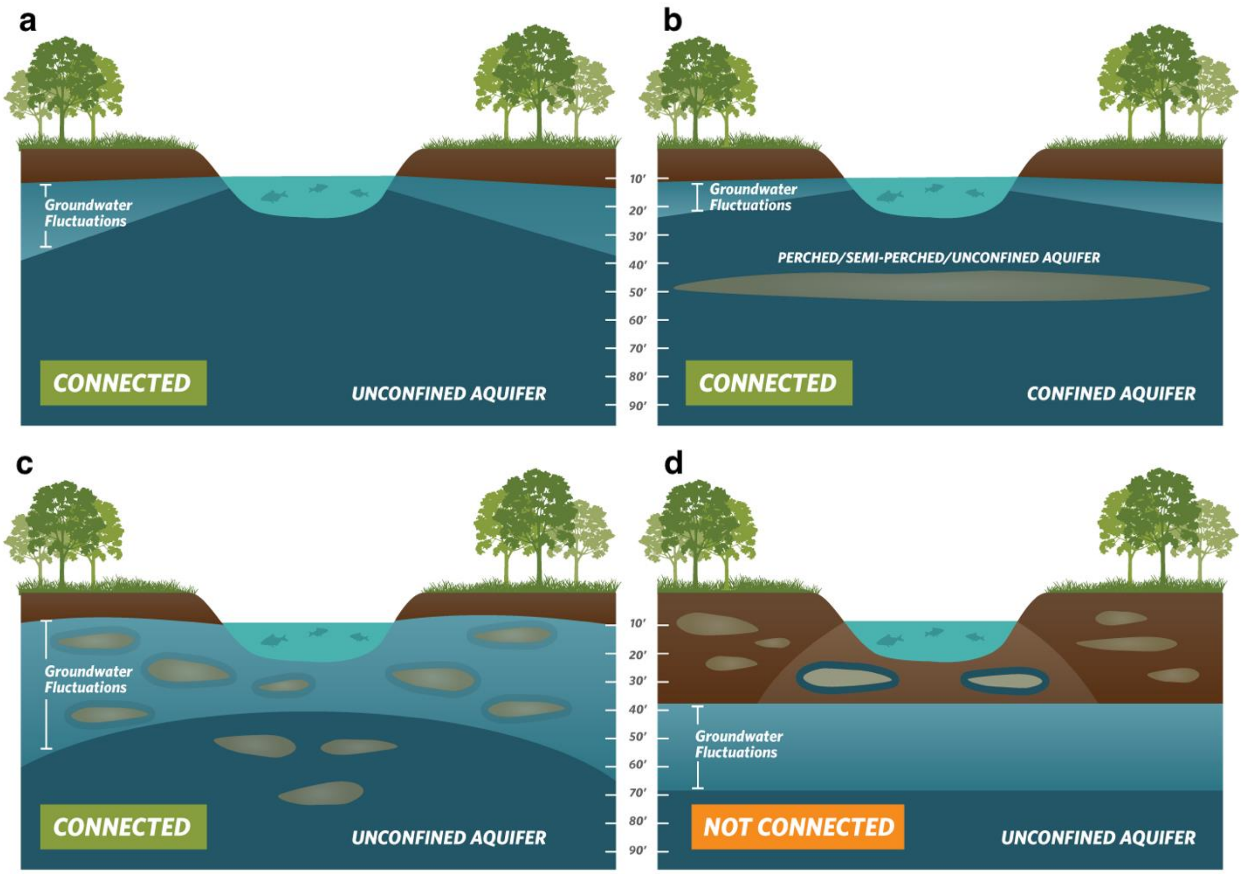

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[13] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[14] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[15] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[16]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network (see Best Practice #6).

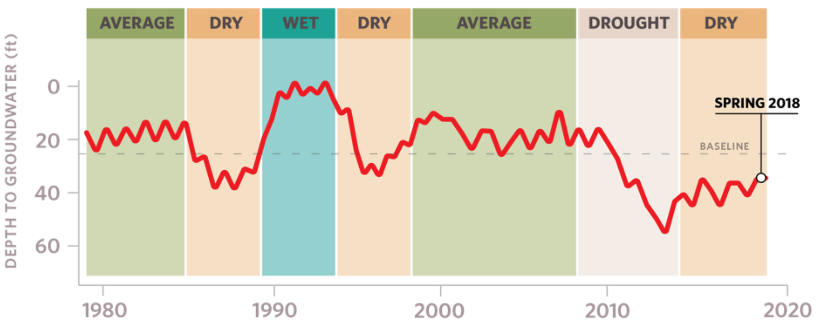

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[13] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[14] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[15] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[16] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[17], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

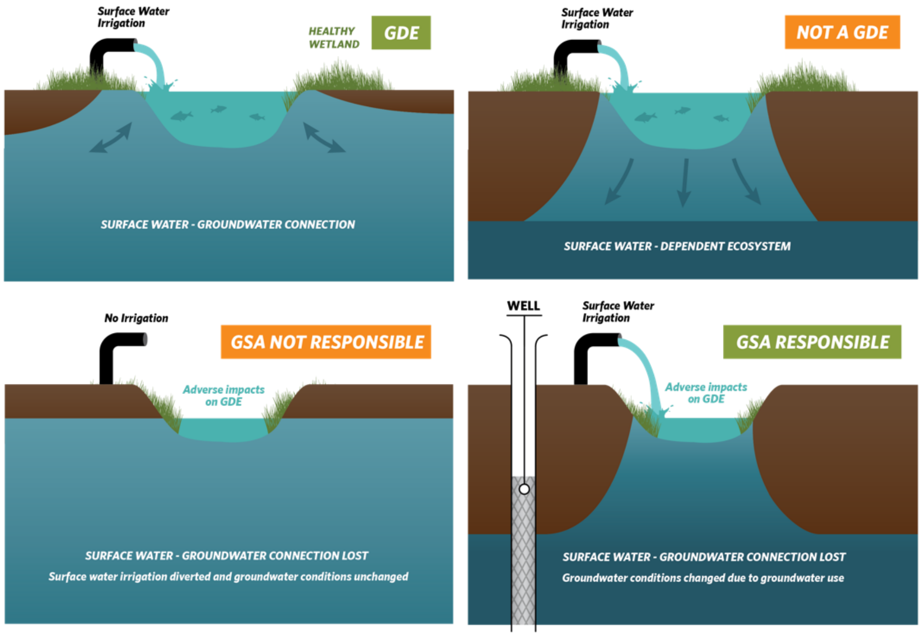

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[17] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

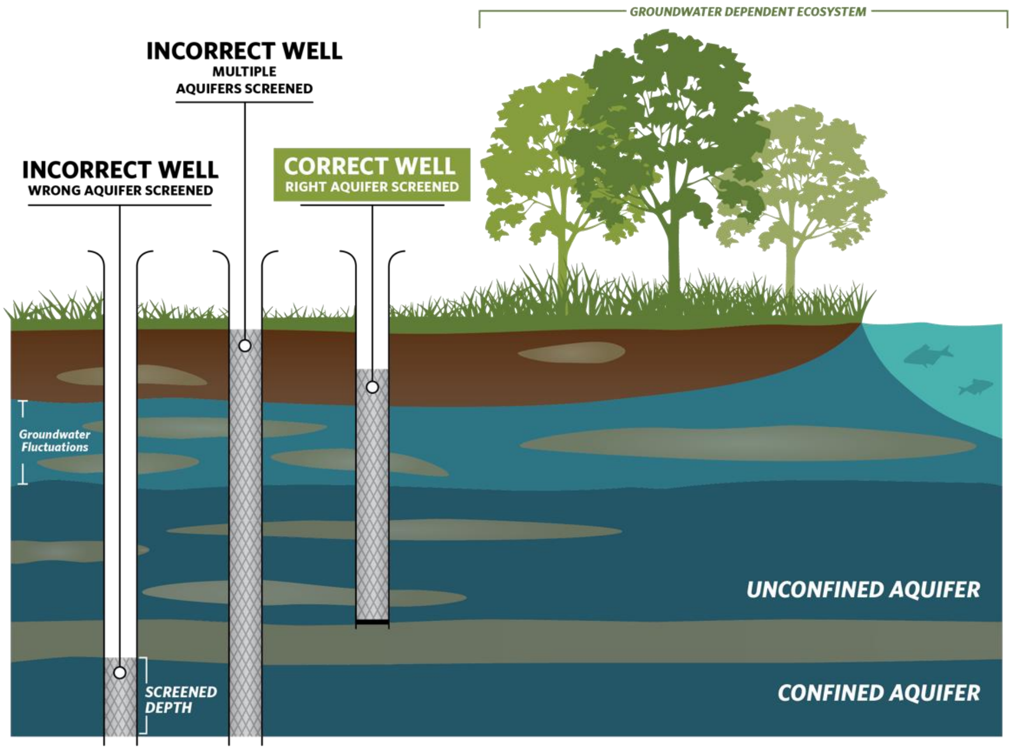

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[18] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

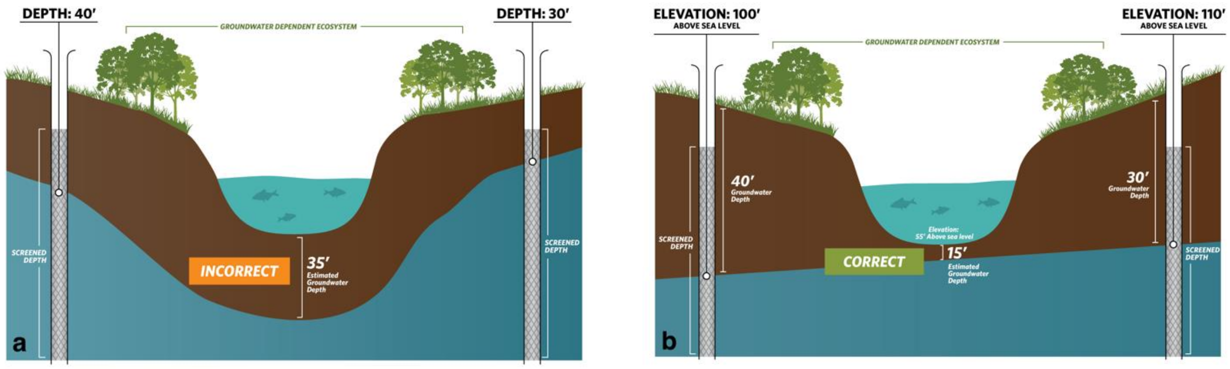

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

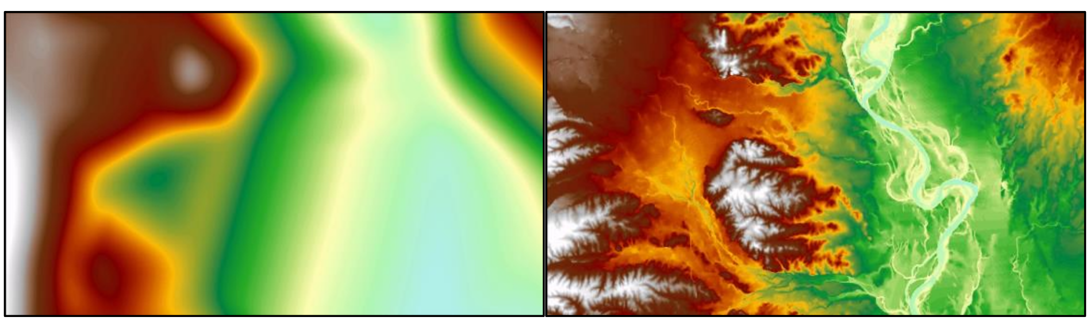

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[18] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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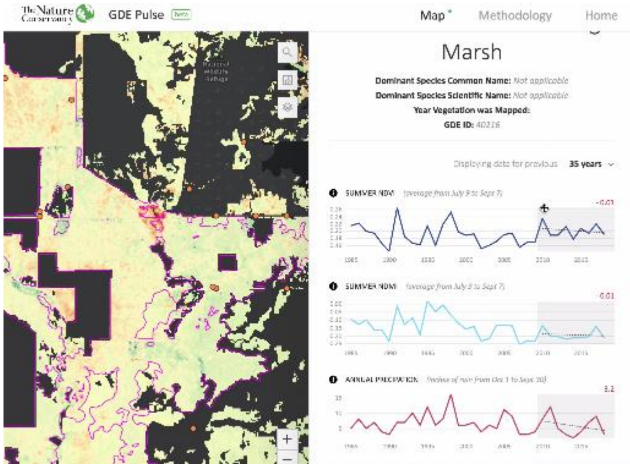
Visit
https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[19]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[20]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[19] *The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#*

[20] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F

The GSA Response to TNC Comments on Draft GSP can be found on DWR's SGMA portal as Part 2 of 2 of TNC's comments on the Final GSP.

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[21]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[22]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[23] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[21] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[22] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[23] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: North Fork Kings Groundwater Sustainability Plan (GSP), Kings Subbasin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the North Fork Kings Groundwater Sustainability Agency's (GSA's) North Fork Kings Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing sustainable groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be insufficient in addressing environmental beneficial uses and users.

The identification of environmental beneficial users, as well as their consideration when establishing the sustainability goal, undesirable results, minimum thresholds and measurable objectives were insufficient (23 CCR §355.4(b)(4)) and lacked best available science (23 CCR §355.4(b)(1)). In the face of existing, severe overdraft, the GSP would allow groundwater management to largely ignore potential impacts to environmental beneficial users. This could result in irreparable harm to these beneficial users, undermining the intent of SGMA to achieve sustainability.

Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address within 180 days. In these cases, we strongly recommend that the Department, at a minimum, set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update. Should the treatment of environmental beneficial users be indicative of the quality of the overall plan, then we recommend the Department deem the plan inadequate.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides the GSA's response to TNC's comments on the Draft GSP. Attachment G provides a map and method summary of potential ISWs.

<u>Our Key Considerations</u>

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We are disappointed to see the feedback that we provided on the draft GSP has been largely ignored in the final plan, as only 5 out of 60 of our comments were adequately addressed in the Final GSP. This indicates poor engagement of environmental beneficial users, which undermines the intent of SGMA to ensure that sustainability be defined locally with the participation of all users. Based on our experience the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan" (23 CCR §355.4(b)(10)).

<u>TNC recommendation</u>: We strongly recommend that DWR require the GSA to prioritize stakeholder engagement through improvements to their stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters (ISWs) – The GSP incorrectly excluded potential and/or actual ISWs because the plan did not employ the best available science. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). ISWs were excluded based on lack of continuous saturation between surface water and groundwater. This justification of automatic removal is incorrect and inconsistent with the definition of ISWs. The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. Therefore, potential ISWs are not being managed in the GSP.

<u>Map and Assessment of potential ISWs</u>:
By combining multiple years and seasons of groundwater depth data, The Nature Conservancy has determined that within the North Fork Kings GSP, 11.9 miles have uncertain connection to groundwater. Attachment G contains a one-page method summary and a GSP-specific map of ISWs in the basin. The interconnected surface water displayed on the map is based on the minimum groundwater depth estimated by the California Department of Water Resources between 2011 and 2018.

Note: In most cases, the groundwater depth data used to generate the ISW map does not include perched aquifers. As such, some streams marked as disconnected could in actuality, be connected.

TNC recommendation: Until a disconnection can be proven, TNC recommends that the GSP include all potential and confirmed ISWs. We recommend that the GSA conduct a thorough analysis of existing data on surface water-groundwater interconnectivity and estimate the quantity and timing of streamflow depletions in the subbasin. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 1,842 acres of potential GDEs occur in the GSA boundary. TNC developed the *Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs*[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

The plan does not adequately identify, map and consider GDEs. We believe that this does not meet plan evaluation criteria (1), (4) and (10), as defined in the 23 CCR §355.4(b). In addition, the Plan does not satisfy the requirement to identify GDEs (23 CCR §Section 354.16(g)) and consider beneficial users throughout the plan. Our review found that NC Dataset polygons were improperly removed from the GDE map based on the following:

- GDEs were rejected on the basis that groundwater levels were greater than 30-ft at a single point in time. This is a technically incorrect approach since groundwater levels fluctuate over seasonal and interannual time scales due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Justifying the removal of NC dataset polygons solely based on this criterion does not acknowledge that groundwater levels temporally vary and the fact that many plant species within GDEs can access groundwater depths beyond 30-ft or have adapted water stress strategies to deal with intermittent periods of deep groundwater levels. Using this methodology disregards groundwater fluctuations and can leave many GDEs unprotected in the GSP.
- The presence or proximity of surface water, which does not necessarily prove that the plants and animals do not access groundwater. GDEs can simultaneously rely on multiple sources of water (i.e., both groundwater and surface water), or shift their reliance on different sources on an interannual or inter-seasonal basis.

TNC recommendation: TNC recommends that the GSA utilize groundwater levels that represent interannual and inter-seasonal variability along with additional information provided in Attachment D which provides best practices for using the NC dataset to identify and consider GDEs throughout the GSP. Specifically, the GSA should use a Digital Elevation Model (DEM) when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment D.

Water Budget – We would like to commend the GSP for including the groundwater demands of riparian vegetation in the historical, current and projected water budgets.

[1] *Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf*

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. As a result, the monitoring network does not adequately characterize GDEs and other environmental beneficial users of surface water and groundwater. Potential GDEs are located along surface water bodies where no further shallow groundwater monitoring is proposed, leaving recognized data gaps unfilled. Potential ISWs have been dismissed in the GSP, without proposed recommendations to improve ISW identification, mapping, and estimates of depletions. Therefore, GDEs and ISWs are not being specifically addressed by the monitoring network in the GSP.

TNC recommendation: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess potential impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but sustainable groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
North Fork Kings Groundwater Sustainability Plan
Comments based on Draft and Final GSP Drafts

The North Fork Kings Groundwater Sustainability Plan (NFKGSP) adopted December 18, 2019 was reviewed by TNC. Public draft GSP comments and responses, provided as Appendix 2B of the GSP, were reviewed and are referred to below. The TNC comments and responses are also provided in Attachment F of this letter. This attachment lists our original comments on the complete public draft GSP as submitted to the GSA during the public comment period, and states whether or not they were addressed in the final GSP [as green text in brackets]. The original comments were re-worded where necessary as noted below. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

[Section 2.5.1 Description of Beneficial Uses and Users (pp. 2-39 to 2-40)]

- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* The beneficial uses and users of groundwater focused on agricultural users, municipal users, disadvantaged communities, and agencies conducting groundwater monitoring, but environmental groups were not listed. **Please describe how environmental groups were engaged during the GSP development process.**
- *[Minor changes to the GSP text do not adequately address our comment.]* The Kings River Fisheries Management Program is described in Section 2.2.2 Limits to Operational Flexibility. This program includes year-round flows, improved temperature control, and monitoring requirements. The SJRRP also increases flows to benefit fisheries. The benefits and requirements of these programs should be discussed here. **Please discuss whether other beneficial uses and users of groundwater in the NFKGSA area are present: Protected Lands, including preserves, refuges, conservation areas, recreational areas and other protected lands; and Public Trust Uses, including wildlife, aquatic habitat, fisheries, and recreation.**
- *[Our comment was not identified in Appendix 2B; no changes to GSP text made.]* The types and locations of environmental uses, species and habitats supported, instream flow requirements, and other designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the NFKGSA area should be specified. **To identify environmental uses and users, please refer to the following:**
  - The NC Dataset (https://gis.water.ca.gov/app/NCDatasetViewer/) which identifies potential presence of groundwater dependent ecosystems in this basin
  - The list of freshwater species located in the Kings Subbasin in Attachment C of this letter. Please take particular note of the species with protected status.

- CDFW's California Natural Diversity Database (CNDDB) (https://www.wildlife.ca.gov/Data/CNDDB)
- USFWS's IPAC report for the North Fork Kings Area of the Subbasin (https://ecos.fws.gov/ipac/)

Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8)

[Section 2.2.1 Monitoring and Management Programs (p. 2-17 to 2-22)]

- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* [Groundwater Level Monitoring (p. 2-17)] The Kings River Conservation District (KRCD) began studying groundwater level trends in 1987 and prepared annual groundwater reports between 2003 and 2014 that included regional groundwater contour maps. In 2005, they developed the Lower Kings Groundwater Management Program (under SB 1938), which includes the North Fork Kings GSA (NFKGSA) area as Management Area B. The KRCD program may cease when a SGMA-approved groundwater monitoring program is implemented for the Kings Subbasin. KRCD serves as the designated monitoring entity under CASGEM for western Fresno and Kings Counties. **Please describe how existing groundwater monitoring programs are protective of GDEs and ISWs or propose additional monitoring that specifically targets GDEs.**
- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* [Groundwater Extraction Monitoring (p. 2-19)] The GSP notes that while municipal water agency wells are metered and the extracted volume is known, most private wells are not metered, so the volume extracted is not known. The text states that "The vast majority of groundwater pumping within the NFKGSA is not currently metered" (p. 2-19). This omission means that the groundwater used must be estimated using factors such as water use per capita and crop water demand per acre. This estimation contributes to the uncertainty of the water budget. **Please describe how this data gap will be filled in the future.**
- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* [Surface Water Monitoring (p. 2-22)] This section briefly describes the types of monitoring by the Kings River Water Authority (KRWA). There is no mention of ISWs or GDEs and how they are monitored. **Please explain the relationship of existing stream flow monitoring to the protection of ISWs and GDEs, and if there are instream flow criteria for the ISWs.**

[Section 2.2.2 Impacts to Operational Flexibility (p. 2-22 to 2-25)]

- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* The Kings River Fisheries Management Program includes year-round flows, improved temperature control, and monitoring requirements. This section should discuss or reference any instream flow requirements, especially flow needs for critical species and their habitats, including the amount, time of year when the flow minimum is specified, the duration, the species for which it applies, associated permits that set forth the requirements, and the regulating agency setting forth the compliance requirements. The Kings River Flood Control District also has built levees along the portion of the Kings River shown in Figure 2-9 (p. 2-24) that are maintained by KRCD with assistance from the United States Army corps of Engineers (USACE). **Please discuss the potential impact of the Kings River Fisheries Management Program on the aquatic species and habitat present along the river.**

[Section 2.3 Relation to General Plans (p. 2-27 to 2-28)]

- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* The General Plans for Fresno County and Kings County apply within the NFKGSA area. Both were completed prior to the development of the GSA. This section should be modified to include a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals. **Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs.**
- *[The GSA's response states that there are no HCPs or NCCPs in NFKGSA. For clarity please add this to GSP text.]* This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the NFKGSA area and if they are associated with critical habitat, GDE or ISW habitats. **Please identify all relevant HCPs and NCCPs within the NFKGSA area and address how GSP implementation will coordinate with the goals of HCPs or NCCPs.**
- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* Please refer to the Critical Species Lookbook[2] to review and discuss the potential groundwater reliance of critical species in the basin. **Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.**

[Section 2.3.4 Permitting New or Replacement Wells (p. 2-29)]

- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* **Please include a discussion of how future well permitting will be coordinated with the GSP to assure achievement of the Plan's sustainability goals.**
- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* The State Third Appellate District recently found that counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF vs. SWRCB and Siskiyou County, No. C083239). **Compliance of well permitting programs with this requirement should be stated in the GSP.**

[Section 2.4.4 Well Abandonment/Well Destruction (p. 2-34)]

[2] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

- *[Our comment was adequately addressed through GSP text changes. Thank you for acknowledging the environmental importance of proper well abandonment and that proper characterization of each individual aquifer zone is necessary for protection of beneficial users of groundwater.]* The counties of Fresno and Kings have the authority to require permits for well abandonment/well destruction, but due to staffing and funding limitations the GSP notes that enforcement of this requirement is limited. **Please describe what actions will be taken by NFKGSA to make sure that wells are properly abandoned.** The GSP also states that well owners will be encouraged to convert the wells into monitoring wells. **Please include text to clarify that only wells screened in one aquifer and thus appropriate for monitoring will be included in the monitoring program.**

Checklist Items 5, 6, and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 3.1.7 Cross-sections (p. 3-15)]

- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* Regional basin-wide cross sections provided in Figures 3-9, 3-12, and 3-13 include the NFKGSA area. These cross-sections do not include a graphical representation of the manner in which shallow groundwater may interact with ISWs or GDEs that would allow the reader to understand this topic. The cross-sections have been taken from a 1969 source and, as reproduced in the GSP, are very difficult to read and understand. **Please reproduce the regional cross-sections so that they can be understood by the reader and update them to illustrate data obtained from more recent well installations. Please clearly state whether localized perched aquifers are present in the basin. Include example near-surface cross sections that depict the conceptual understanding of shallow groundwater and river interactions at different locations, including perched and regional aquifers, as well as any potential GDEs and ISWs**.

[Section 3.1.8.1 Geologic Formations (pp. 3-23 to 3-24)]

- *[Our comment has been adequately addressed through GSP text changes. Thank you for acknowledging that proper characterization of the unconfined aquifer zone is necessary for protection of environmental beneficial users of groundwater.]* The first aquitard is the extensive iron-silica hardpan layer of the Riverbank Formation, which is important in identifying where groundwater recharge can occur. The A and C clays are present in the western part of the NFKGSA area, as depicted on Figure 3-17 (p. 3-27). The E-clay, commonly known as the Corcoran Clay, is present in most of the NFKGSA area and confined conditions exist below the Corcoran Clay. In the past, it was assumed that only one aquifer existed in the eastern part where the E-clay is absent. However, this assumption is being reevaluated. KDSA has described in Appendix 3A how locally extensive clay layers can function as an aquitard, forming a confined aquifer below. This evaluation will continue and the GSP states later in Section 5 that the confined aquifer may be monitored separately in the future. **It is**

important to confirm that only wells with screened intervals in the unconfined aquifer are being used to compare with surface water to identify and confirm potential GDEs.

[Section 3.1.8.2 Aquifer Characteristics and Properties (p. 3-29)]

- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* In the NFKGSA area, the base of the usable aquifer corresponds with the base of freshwater, defined in the text as groundwater with total dissolved solids (TDS) of 2,000 milligrams per liter (mg/l) (KDSA, 2010), consistent with other GSAs in the Subbasin. As noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** Properly defining the bottom of the basin will prevent the possibility of extractors with wells deeper than the basin boundary from claiming exemption from SGMA due to their well residing outside the vertical extent of the basin boundary.

[Section 3.1.12 Recharge and Discharge Areas (pp. 3-39 to 3-43]

- *[The name of the wetlands inventory was corrected but no other changes to the GSP text were made. Our original comment below has been re-worded to capture this change.]* Wetland including freshwater emergent wetlands and forest shrub wetlands were mapped along the Kings river, as shown on Figure 3-26 (p. 3-45), as identified from US Fish and Wildlife's National Wetland Inventory (NWI). "Some of the areas shown indicate perched shallow groundwater conditions caused by a restrictive clay layer" (p. 3-43). **Please clarify which clay layer is being referred to in this sentence. In this section, please refer to the discussion of GDEs in Section 3.2.8 and mapped on Figure 3-52. The NWI does not always include or segregate separate existing wetlands that are on the periphery of other features. Please describe the wetland types in more detail. If they are truly vernal pools confined by a clay layer then they are not GDEs, but they must meet the criteria of a vernal pool as described by the California Rapid Assessment Methodology or the USACE to qualify.**
- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* The text discusses recharge basins, including wastewater effluent ponds, stormwater basins, and dedicated recharge basins, but these are not shown on Figure 3-21 (p. 3-37). **Please indicate whether the recharge basins are or could be operated as habitat suitable for migrating birds or other species and could be included in an HCP or NCCP.**

[Section 3.2.1 Groundwater Level Data (pp. 3-46 to 3-55)]

- *[The GSP text was updated to refer to a map of locations where the vertical gradients have been measured, therefore this part of our original comment was removed. No other GSP text changes were made.]* The NFKGSP notes that "The dramatic lowering of hydraulic heads in the confined parts of the aquifer has resulted in a large net downward movement of water through bore holes. This vertical flow occurs in both pumped and un-pumped wells during the growing season" (Faunt, CC ed. 2009) (p. 3-53). There is insufficient data to show groundwater elevation contours for the confined aquifer in the NFKGSA. **Please expand this section to include a discussion of the impacts of vertical flow on ISWs and GDEs.**

<u>Checklist Items 8, 9, and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)</u>

[Section 3.2.7 Surface Water and Groundwater Interconnection (pp. 3-95 to 3-96)]

- *[Neither the GSA's response nor changes made to GSP text adequately addresses our comment.]* **Please provide depth to groundwater contour maps. See Attachment D for best practices for completing this step. Specifically, ensure that the first step is contouring groundwater elevations, and the subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape**. This will provide much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. Contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make.
- *[Our comment was not identified in Appendix 2B; no changes to the GSP text were made.]* ISWs are best estimated by first determining which reaches are completely disconnected from groundwater. This approach would involve comparing groundwater elevations with a land surface DEM that could identify which surface waters have groundwater consistently below surface water features, such that an unsaturated zone would separate surface water from groundwater. **Please evaluate with depth to groundwater contour maps as described above and see Attachment D for best practices to complete this step.**
- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. The NFKGSP places emphasis on whether the flow in a given reach is continuous or not. In contrast, data are given for five reaches of the Kings River where flow was present between 14 and 39 percent of the time in the last 10 years. The GSP concludes: "There is no data currently to suggest any interconnected surface waters in the NFKGSA" (p. 3-96), however this statement has not been proven by evidence presented in the GSP No data were included to show the relationship between the depth to groundwater and the riverbed, therefore the presence of ISWs cannot be ruled out. **Please provide further evidence and analysis for the determination of whether ISWs exist in the NFKGSA area**. **As stated above, please include depth to groundwater maps utilizing a DEM of the land surface. Provide a cross-section and / or corresponding hydrographs to**

show the relationship between the river channel and the depth to groundwater at wells near the river.

Checklist Items 11 to 15, Identifying and Mapping GDEs (23 CCR §354.16)

[Section 2.4.11 Impacts on Groundwater Dependent Ecosystems (pp. 2-36 to 2-37) and Section 3.2.8 Groundwater Dependent Ecosystems (pp. 3-96 to 3-97)]

- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* The NC dataset is a starting point for GSAs to identify GDEs in their basin / subbasin. The NC dataset comprises 1,842 acres of potential GDEs mapped within the NFKGSA area, representing a significant amount of GDEs to be considered. **Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled by the monitoring network.**
- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* Figure 3-53 presents Spring 2017 depth to groundwater contours overlain on NC Dataset polygons. **Please provide more details on how the depth to groundwater contours were developed by confirming**:
  - that wells monitoring the upper unconfined aquifer are being used to verify whether polygons in the NC dataset are supported by groundwater;
  - the wells used for interpolating depth to groundwater sufficiently close (<5km) to NC Dataset polygons reflect local conditions relevant to ecosystems;
  - the wells used for interpolating depth to groundwater are screened within the surficial unconfined aquifer and capable of measuring the true water table; and
  - depth to groundwater is contoured using groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a DEM to estimate depth to groundwater contours across the landscape. This will provide much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from measurements at wells assumes that the land surface is constant, which is a poor assumption to make. It is better to assume that water surface elevations are constant in between wells, and then calculate depth to groundwater using a DEM of the land surface to create the contour maps.
- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* It is highly advised that seasonal and interannual groundwater fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one point in time (e.g., Spring 2017) can misrepresent groundwater levels required by GDEs, and inadvertently result in

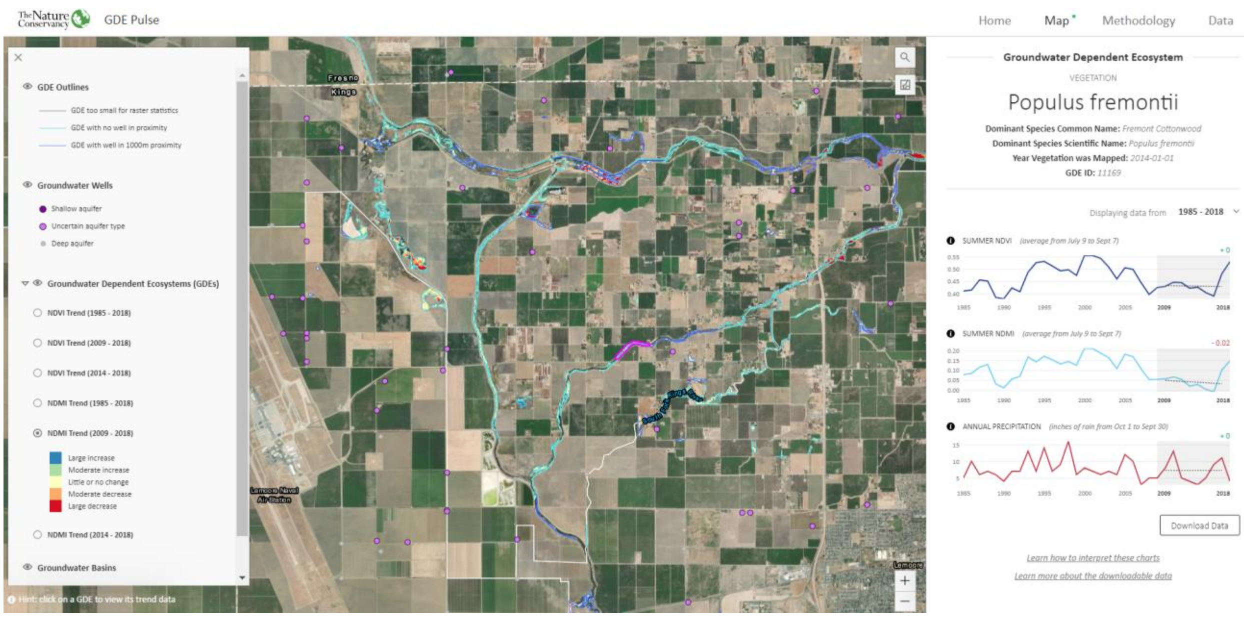
adverse impacts to the GDEs. **We highly recommend using depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. Ensure that groundwater condition data prior to the SGMA benchmark date of January 1, 2015 is included in the analysis. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, we strongly advise the inclusion of those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network to avoid adverse impacts.**

- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* **Please provide rationale for the 30-foot criteria cited in the text.** The text states (p. 3-96): "Recognizing that much of the Kings Subbasin has a depth to groundwater greater than the deepest vegetative GDE rooting depth of thirty feet, many of the GDEs identified in the NC Dataset Viewer were mischaracterized." **In TNC's GDE Guidance, the depth criterion of 30 feet is presented as a criterion for *inclusion*, not a standalone criterion for *exclusion*.** In other words, if groundwater is within 30 feet of the ground surface, then a GDE can be identified. If it is not, then further analysis must be conducted (see Appendix III of the GDE Guidance). **The <u>actual</u> rooting depth of vegetation growing in the area should be considered, and this will vary by species dominance and habitats present. Please indicate what vegetation is present in the possible GDEs and the estimated maximum rooting depths for those species.** Many phreatophytes can and will root deeper than 30 feet but are commonly constrained by the saturated zone at and below the ground water table. As groundwater declines or rises, roots redistribute over the water table in the unsaturated zone. This may happen on a seasonal and annual basis. Furthermore, rooting depths are likely to spatially vary based on the local hydrologic conditions available to the plant. Maximum rooting depths do not take capillary action into consideration, which will vary with soil type and is an important consideration since woody phreatophytes generally do not prefer to have their roots submerged in groundwater for extended periods of time, and hence can access groundwater at deeper depths.
- *[Our comment was not identified in Appendix 2B; no changes to the GSP text were made.]* The text states (p. 3-97): "[V]egetation and wetlands identified by the Nature Conservancy are thought to be dependent on the surface flows in the river rather than on groundwater," although the GSP acknowledges that a shallow groundwater monitoring program is proposed to verify the conditions. **Please ensure that if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, those polygons are included in the GSP <u>until</u> data gaps are reconciled in the monitoring network.**

<u>Checklist Items 16 to 20, Describing GDEs (23 CCR §354.16)</u>

[Section 3.2.8 Groundwater Dependent Ecosystems (p. 3-96)]

- *[The GSA’s response does not adequately address our comment and no changes to the GSP text were made.]* **Please provide information on the historical or current groundwater conditions in the GDEs or the ecological conditions present.** Refer to GDE Pulse (https://gde.codefornature.org; See Attachment E of this letter for more details) or any other locally available data (e.g., leaf area index, evapotranspiration or other data) to describe depth to groundwater trends in and around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in the NFKGSA area.



- *[The GSA’s response does not adequately address our comment and no changes to the GSP text were made.]* **Please provide an ecological inventory (see Appendix III, Worksheet 2 of the GDE Guidance) for all potential GDEs that includes the vegetation types or habitat types and rank the GDEs as having a high, moderate or low value; and what characterizes the rank.**
- *[The GSA’s response does not adequately address our comment and no changes to the GSP text were made.]* **Please identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat were found in or near any of the GDEs since some organisms rely on uplands and wetlands during different stages of their lifecycle.** Resources for this include the list of freshwater species located in the Kings Subbasin that can be found in Attachment C of this letter, the Critical Species Lookbook, and CDFW’s CNDDB database.
- *[The GSA’s response does not adequately address our comment and no changes to the GSP text were made.]* **For each identifiable GDE unit with supporting hydrological datasets please include the following:**
    - Plot and provide hydrological datasets for each GDE.

    - Define the baseline period in the hydrologic data.
    - Classify GDE units as having high, moderate, or low susceptibility to changes in groundwater.
    - Explore cause-and-effect relationships between groundwater changes and GDEs.
- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* **For each identifiable GDE unit without supporting hydrological datasets please describe data gaps and / or insufficiencies. Where there is incomplete, uncertain or conflicting data, we strongly advise that the potential GDE be recognized to avoid adverse impacts.**
- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* **Compile and synthesize biological data for each GDE unit by including:**
    - Biological datasets for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.
    - Describe data gaps and insufficiencies.
- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* **Provide a description of the potential effects on GDEs, land uses, and property interests, including:**
    - Cause-and-effect relationships between GDE and groundwater conditions.
    - Potential impacts to GDEs that are considered to be "significant and unreasonable".
    - Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters, critical habitat constraints, etc.) for significant impacts to relevant species or ecological communities.
    - Land uses that and consider recreational uses (e.g., fishing/hunting, hiking, boating, etc.).
    - Property interests, such as privately and publicly protected conservation lands and opens spaces, wildlife refuges, parks, and natural preserves.

<u>Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)</u>

[Section 3.3.6 Outflows from Groundwater System (p. 3-115)]

- *[Neither the GSA's response nor changes made to the GSP text adequately addresses our comment.]* **Please clarify whether a term is included for native or riparian vegetation evapotranspiration and for wetlands in the North Fork Kings historical, current, and future water budgets.**
- *[Neither the GSA's response nor changes made to the GSP text adequately addresses our comment.]* "During the 1997-2011 period, average annual unconfined groundwater outflows from North Fork Kings Subbasin were estimated to be 3,200 acre-feet (AF) and confined groundwater outflow was estimated to be 13,000 AF. The unconfined aquifer outflow went to McMullin Area GSA, and the confined outflows went to the adjacent Westside Subbasin" (p. 3-118). These two values were added to obtain the estimate for average annual total groundwater outflow of 16,200 AF. **Please describe how this estimate was made, given the limited number of wells installed in the confined system below the Corcoran Clay.**

- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* The Friant Water Authority estimated climate change impacts on the San Joaquin River using the Water Storage Investment Program (WSIP) data sets. Given the uncertainty associated with Kings River water supply into the future, the assumption was made that the historical water delivery from the Kings River would be maintained. This assumption is highly uncertain and is not conservative. The diversion of Kings River flows may require additional provision for storage in the non-irrigation or low-irrigation season. **Please add discussion of the potential impacts to the flow in the Kings River and to groundwater conditions on GDEs, aquatic ecosystems and instream flow requirements due to climate change.**

<u>Checklist Items 23 to 25 – Sustainability Goal (23 CCR §354.24)</u>

[Section 4.1 Sustainability Goal (p. 4-1)] The Sustainability Goal does not consider GDEs or ISWs.

- *[Neither the GSA's response nor changes made to GSP text adequately addresses our comment.]* **Since GDEs are likely present in the NFKGSA area (please see comments under Checklist Items 16-20) they should be recognized as beneficial users of groundwater and should be included in the Sustainability Goal. In addition, a statement about any intention to address pre-SGMA impacts should be included.**
- *[Neither the GSA's response nor changes made to GSP text adequately addresses our comment.]* The Plan states that there are time periods of ISW connectivity along the Kings River; however, they are dismissed because they are not continuously connected. **TNC notes evidence of connectivity between surface water and groundwater and potential GDEs have been identified near the Kings River. We disagree with the statement that there are not ISWs within the GSA. Even though the ISWs are not continuously connected (see comments under Checklist Items 8-10), they are still connected at some point in time on either a longitudinal and / or lateral profile, and they should be included in the Sustainability Goal.**
- *[Neither the GSA's response nor changes made to GSP text adequately addresses our comment.]* GDEs are dependent, in part, on suitable water quality; however, the Plan only considers water quality for irrigation and domestic use. **TNC recommends including ISWs and their potential GDEs in the sustainability goal and criteria. Since GDEs may be affected by degradation of water quality, they should be included in the Sustainability Goal.**
- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* Figure 4-1 represents Path A as shown in the DWR Sustainable Management Criteria BMP (Figure 15, Potential Paths to Sustainability). This is a problematic concept however, since the Subbasin is already designated as being critically overdrafted, despite that the NFKGSA area is not yet experiencing undesirable results. This approach may slow recovery of adjacent areas or have unintended consequences that contribute to undesirable results within

the NFKGSA area and adjacent areas. **Please elaborate on how this approach to sustainability will affect the ability of adjacent GSP areas within the Subbasin to recover, and how potential unintended consequences with the NFKGSA area and adjacent areas will be evaluated.**

Checklist Item 26 – Measurable Objectives (23 CCR §354.30)

[Sections 4.2.3 Measurable Objectives for Groundwater Levels (p. 4-15)]

- *[Neither the GSA's response nor changes made to the GSP text adequately addresses our comment.]* This Measurable Objective does not consider GDEs. GDEs are often adjacent to streams or associated with riparian corridors where ISWs exist, even if only seasonally or discontinuously along a longitudinal or lateral profile. **Please include GDEs (see comments under Checklist Items 16-20) in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Sections 4.5.3 Measurable Objectives for Water Quality (p. 4-35)]

- *[Neither the GSA's response nor changes made to the GSP text adequately addresses our comment.]* This Measurable Objective does not consider water quality needs of GDEs. **Please include a discussion about GDEs and water quality and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Sections 4.7.2 Measurable Objectives for Interconnected Surface Water and Groundwater (p. 4-46)]

- *[Neither the GSA's response nor changes made to the GSP text adequately addresses our comment.]* This Measurable Objective does not consider ISWs. The Plan states that there are time periods of ISWs along the Kings River; however, they are dismissed because they are not continuously connected. Even though the ISWs are not continuously connected they should be included in the Measurable Objectives. **Please include ISWs (see comments under checklist items 8-10) in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment. The analysis for potential depletion of ISWs in Section 4.7 should include all beneficial users of surface water that could be affected by groundwater withdrawals, including environmental. Please include instream flow requirements in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

Checklist Item 27-29 – Minimum Thresholds (23 CCR §354.28)

[Sections 4.2.2 Minimum Thresholds for Groundwater Levels (p. 4-7)]

- *[Neither the GSA's response nor changes made to the GSP text adequately addresses our comment.]* This Minimum Threshold does not consider GDEs. **Please include GDEs in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Sections 4.5.2 Minimum Thresholds for Water Quality (p. 4-32)]

- *[Neither the GSA's response nor changes made to the GSP text adequately addresses our comment.]* This Minimum Threshold does not consider water quality needs of GDEs. **Please include a discussion about GDEs and water quality and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Sections 4.7 Minimum Thresholds for Interconnected Surface Water and Groundwater (p. 4-46)]

- *[Neither the GSA's response nor changes made to the GSP text adequately addresses our comment.]* This Minimum Threshold does not consider GDEs. **Please include GDEs in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**
- *[Neither the GSA's response nor changes made to the GSP text adequately addresses our comment.]* The Plan states that there are time periods of ISWs along the Kings River (p. 3-95); however, they are dismissed because they are not continuously connected. ISWs that are not continuously connected spatially and/or temporally are still ISWs and should not be excluded from this GSP. **Even though the ISWs are not continuously connected, they are still ISWs, and should be included in the Measurable Objectives.**
- *[Neither the GSA's response nor changes made to the GSP text adequately addresses our comment.]* The analysis for potential depletion of ISWs in Section 4.7 should include all beneficial uses and users of surface water that could be affected by groundwater withdrawals, including environmental users. **Please include any instream flow and critical habitat requirements for the Kings River in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

<u>Checklist Item 30-36 – Undesirable Results (23 CCR §354.26</u>)

[Section 4.2.1 Undesirable Results (for groundwater levels) (p. 4-3)]

- *[Neither the GSA's response nor changes made to the GSP text adequately addresses our comment.]* This section only describes undesirable results relating to human beneficial uses of groundwater and neglects environmental beneficial uses that could be adversely affected by chronic groundwater level decline. **Please add**

"potential adverse impacts to GDEs" and native freshwater species to the list of potential undesirable results presented in Section 4.2.

- *[Our comment was not identified in Appendix 2B; no changes to GSP text were made.]* The GDE Pulse web application developed by TNC provides easy access to 35 years of satellite data to view trends of vegetation metrics, groundwater depth (where available), and precipitation data. This satellite imagery can be used to observe trends for NC dataset polygons within and near the GSA. Over the past 10 years (2009-2018), some NC dataset vegetation polygons have experienced adverse impacts to vegetation growth and moisture along the Kings River. An example screen shot from the GDE Pulse tool is presented under Checklist Items 11-15 above.

[Section 4.5.1 Undesirable Results (for groundwater quality) (p. 4-28)]

- *[Text was added to the GSP that further discussed and referenced the citation in our below comment. Thank you for recognizing the negative environmental consequences of overpumping and dewatering of aquitards.]* This section only describes undesirable results in terms of meeting drinking water standards. The following is a link to a paper by Smith, Knight and Fendorf (2018) titled "Overpumping leads to California groundwater arsenic threat": (https://www.nature.com/articles/s41467-018-04475-3). **The section should be modified to state that overpumping and dewatering of aquitards has been identified as a potential source of elevated arsenic concentrations above drinking water standards in San Joaquin Valley aquifers. In addition, any potential undesirable results that may impact GDEs and freshwater species should be discussed in this section.**

[Sections 4.7.1 Undesirable Results (for Interconnected Surface Water and Groundwater) (p 4-46)]

- *[Neither the GSA's response nor changes made to the GSP text adequately addresses our comment.]* This section does not consider Undesirable Results for ISWs. The Plan states that there are time periods of ISWs along the Kings River; however, they are dismissed because they are not continuously connected. **Even though the ISWs are not continuously connected they should be included in the Undesirable Results.** The analysis for potential depletion of ISWs in Section 4.7 should include all beneficial users of surface water that could be affected by groundwater withdrawals, including environmental. Please include instream flow requirements and critical habitat designations for the Kings River in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.

Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)

[Section 5.2 Groundwater Levels (pp. 5-3 to 5-15)]

- *[Neither the GSA's response nor changes made to the GSP text adequately addresses our comment.]* **Please address how the requirement to link and correlate groundwater level declines to biological responses, and significant**

and adverse impacts to GDEs and ISWs will be addressed by the monitoring network.

- *[Neither the GSA's response nor changes made to the GSP text adequately addresses our comment.]* The proposed wells to be used for monitoring groundwater levels in the unconfined aquifer and confined aquifers are shown in Figure 5-1 (p. 5-4). Areas with spatial data gaps have been identified and are shown on the map. Many of the monitoring wells are missing well construction information, which was acknowledged as a known data gap on p. 5-10. **To accurately characterize GDEs, please clarify how the unconfined aquifer will be monitored and how many wells will be used.**
- *[Our comment was not identified in Appendix 2B; no changes to the GSP text were made.]* The Kings Subbasin has requested DWR grant funds to install cluster wells that are screened in multiple units. **Please explain how the data from these new wells will be used.**

[Section 5.7 Depletion of Interconnected Surface Water (pp. 5-36 to 5-41)]

- *[Neither the GSA's response nor changes made to the GSP text adequately addresses our comment.]* Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater *and related surface conditions* (emphasis added). Groundwater level monitoring alone may be insufficient to establish a linkage between groundwater extraction and potentially resulting impacts to environmental resources associated with GDEs and ISWs. The cause-effect relationship between groundwater levels and the biological responses that could result in significant and unreasonable impacts to ISWs and GDEs depends on a number of complicated factors, and this relationship is not characterized or discussed. As such, it is not possible to determine whether the proposed monitoring is sufficiently protective to ensure significant and unreasonable impacts to GDEs and ISWs will be prevented. **Please offer more specific recommendations for reconciling data gaps in monitoring for ISWs. Include recommendations for shallow monitoring wells, stream gauges, and nested/clustered wells along surface water features to improve ISW mapping and inform an adequate analysis. Please discuss how the data will be used to verify possible GDEs and reaches that include ISWs.**

Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)

[Section 6.1 Introduction (p. 6-2)]

- *[The phrase 'multiple benefits' was added to the GSP text. Thank you for noting the importance of recognizing multiple benefits. No other GSP text changes were made.]* The NFKGSA area includes many GDEs and ISWs (see our comments under checklist items 8-10 and 16-20 above) that are beneficial uses and users of groundwater and may include potentially sensitive resources and protected lands. Environmental resource protection needs should be considered in establishing project priorities. In addition, consistent with existing grant and funding guidelines for SGMA-related work, priority should be given to multi-benefit projects that can address water quantity as well as providing environmental benefits or benefits to disadvantaged communities. **Please include environmental benefits and multiple benefits as criteria for assessing project priorities.**

[Section 6.2 Projects for Water Supply Augmentation (pp. 6-3 to 6-52)]

- *[The GSA's response does not adequately address our comment and no changes to the GSP text were made.]* This Section identifies many important projects; however, the descriptions of Measurable Objectives for these projects only identifies benefits to water level and storage. Since maintenance or recovery of groundwater levels, or construction of recharge facilities, may have potential environmental benefits in many cases i**t would be advantageous to demonstrate multiple benefits from a funding and prioritization perspective.**
  - **For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.**
  - If ISWs will not be adequately protected by those listed, **please include and describe additional management actions and projects targeted for protecting ISWs.**
  - Recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such multiple-benefit projects and facilities have been incorporated into local HCPs and NCCPs, more fully recognizing the value of the habitat that they provide and the species they support. For projects that construct recharge ponds, **please consider identifying if there is habitat value incorporated into the design and how the recharge ponds will be managed to benefit environmental users.**
  - For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

[Section 6.3 Management Actions (p. 6-52)]

- *[Management Action EO-3 (Water Level Impacts to Beneficial Uses and Users) was added to the GSP. Thank you for recognizing the importance of outreach to stakeholders including environmental groups during plan implementation to consider the interests of all beneficial uses and users of groundwater.]* This section discusses the Management Actions for GSP implementation and SGMA compliance; however, these actions are focused on meeting groundwater level and storage measures and do not include support for GDEs or ISWs. **Please consider modifying the Management Actions to include education and outreach for protection of GDEs and ISWs. Please update Sections 6.3.1.2 (p. 6-53) and 6.3.6.2 (p. 6-80) to include GDEs and ISWs, as well as specific management of these ecosystems and the species they provide for.**

Attachment C

Freshwater Species Located in the Kings Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Kings Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[3]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[4] as well as on TNC's science website[5].

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Birds				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	BCC	SCC	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		SCC	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		SCC	

[3] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[4] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[5] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		SCC	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cypseloides niger	Black Swift	BCC	SCC	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	BCC	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	BCC	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		SSC	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			

Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		SSC	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		SSC	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		SSC	BSSC - Third priority
Crustaceans				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	SSC	IUCN - Vulnerable
Branchinecta mesovallensis	Midvalley Fairy Shrimp		SSC	
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	SSC	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		SSC	IUCN - Near Threatened
Fishes				
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Cottus asper ssp. 1	Prickly sculpin			Least Concern - Moyle 2013
Cottus gulosus	Riffle sculpin		SSC	Near-Threatened - Moyle 2013
Gasterosteus aculeatus microcephalus	Inland threespine stickleback		SSC	Least Concern - Moyle 2013

Lampetra hubbsi	Kern brook lamprey		SSC	Vulnerable - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		SSC	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		SSC	Near-Threatened - Moyle 2013
Mylopharodon conocephalus	Hardhead		SSC	Near-Threatened - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus tshawytscha - CV fall	Central Valley fall Chinook salmon	SSC	SSC	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV late fall	Central Valley late fall Chinook salmon	SSC		Endangered - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
Herps				
Actinemys marmorata marmorata	Western Pond Turtle		SSC	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus boreas halophilus	California Toad			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	SSC	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	SSC	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	SSC	ARSSC
Taricha torosa	Coast Range Newt		SSC	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis fitchi	Valley Gartersnake			Not on any status lists
Thamnophis sirtalis sirtalis	Common Gartersnake			
Insects and Other Invertebrates				
Acentrella insignificans	A Mayfly			

Acentrella spp.	Acentrella spp.			
Anax junius	Common Green Darner			
Argia agrioides	California Dancer			
Argia emma	Emma's Dancer			
Argia nahuana	Aztec Dancer			
Argia spp.	Argia spp.			
Baetidae fam.	Baetidae fam.			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Brillia spp.	Brillia spp.			
Chironomidae fam.	Chironomidae fam.			
Cordulegaster dorsalis	Pacific Spiketail			
Cricotopus spp.	Cricotopus spp.			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Enallagma cyathigerum				Not on any status lists
Epeorus spp.	Epeorus spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Erpetogomphus compositus	White-belted Ringtail			
Erythemis collocata	Western Pondhawk			
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon spp.	Fallceon spp.			
Glossosoma spp.	Glossosoma spp.			
Glossosomatidae fam.	Glossosomatidae fam.			
Heptageniidae fam.	Heptageniidae fam.			
Hetaerina americana	American Rubyspot			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Ischnura perparva	Western Forktail			
Lepidostoma baxea	A Caddisfly			
Lepidostoma spp.	Lepidostoma spp.			
Lestes congener	Spotted Spreadwing			

Libellula croceipennis	Neon Skimmer			
Libellula saturata	Flame Skimmer			
Limnophyes spp.	Limnophyes spp.			
Ochrotrichia burdicki	A Caddisfly			
Pachydiplax longipennis	Blue Dasher			
Pantala flavescens	Wandering Glider			
Pantala hymenaea	Spot-winged Glider			
Plathemis lydia	Common Whitetail			
Polypedilum spp.	Polypedilum spp.			
Protoptila spp.	Protoptila spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Serratella micheneri	A Mayfly			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Stylurus olivaceus	Olive Clubtail			
Telebasis salva	Desert Firetail			
Tramea lacerata	Black Saddlebags			
Tricorythodes spp.	Tricorythodes spp.			
Zoniagrion exclamationis	Exclamation Damsel			
Mammals				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
Mollusks				
Anodonta californiensis	California Floater		SSC	
Ferrissia spp.	Ferrissia spp.			
Gyraulus spp.	Gyraulus spp.			
Margaritifera falcata	Western Pearlshell		SSC	
Menetus spp.	Menetus spp.			
Physa spp.	Physa spp.			
Physella virgata	Protean Physa			CS
Pisidium spp.	Pisidium spp.			
Planorbella tenuis	Mexican Rams-horn			CS
Planorbella trivolvis	Marsh Rams-horn			CS

Pyrgulopsis stearnsiana	Yaqui Springsnail			T
Sphaeriidae fam.	Sphaeriidae fam.			
Plants				
Alnus rhombifolia	White Alder			
Alopecurus carolinianus	Tufted Foxtail			
Alopecurus saccatus	Pacific Foxtail			
Anemopsis californica	Yerba Mansa			
Bolboschoenus maritimus ssp. paludosus	Saltmarsh Bulrush			Not on any status lists
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Carex pellita	Woolly Sedge			
Castilleja campestris ssp. succulenta	Fleshy Owl's-clover	Threatened	Endangered	CRPR - 1B.2
Cephalanthus occidentalis	Common Buttonbush			
Chloropyron palmatum	NA	Endangered	SSC	CRPR - 1B.1
Cyperus acuminatus	Short-point Flatsedge			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus squarrosus	Awned Cyperus			
Downingia bella	Hoover's Downingia			
Downingia cuspidata	Toothed Calicoflower			
Eleocharis acicularis ssp. acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Elodea canadensis	Broad Waterweed			
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle		SSC	CRPR - 1B.2
Eryngium vaseyi ssp. vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euphorbia hooveri	NA			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Hydrocotyle umbellata	Many-flower Marsh-pennywort			
Hydrocotyle verticillata ssp. verticillata	Whorled Marsh-pennywort			

Hypericum anagalloides	Tinker's-penny			
Juncus acuminatus	Sharp-fruit Rush			
Juncus xiphioides	Iris-leaf Rush			
Lasthenia ferrisiae	Ferris' Goldfields		SSC	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lilium pardalinum ssp. pardalinum	Leopard Lily			
Ludwigia palustris	Marsh Seedbox			
Ludwigia peploides ssp. peploides	Floating Water Primrose			Not on any status lists
Marsilea vestita ssp. vestita	Hairy Pepperwort			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Mimulus latidens	Broad-tooth Monkeyflower			
Mimulus pilosus	Snouted Monkey Flower			Not on any status lists
Mimulus tricolor	Tricolor Monkeyflower			
Myosurus minimus	Little Mouse Tail			
Navarretia leucocephala ssp. leucocephala	White-flower Navarretia			
Orcuttia inaequalis	San Joaquin Valley Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Orcuttia pilosa	Hairy Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Persicaria lapathifolia	Common Knotweed			Not on any status lists
Persicaria punctata	Dotted Smartweed			Not on any status lists
Phalaris arundinacea	Reed Canarygrass			
Pilularia americana	Pillwort			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys distantiflorus	California Popcorn-flower			
Plagiobothrys undulatus	Coast Allocarya			Not on any status lists
Platanus racemosa	California Sycamore			
Pogogyne douglasii	Douglas' Pogogyne			
Potamogeton diversifolius	Water-thread Pondweed			
Potamogeton nodosus	Longleaf Pondweed			
Potamogeton pusillus pusillus	Slender Pondweed			

Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Puccinellia simplex	Little Alkali Grass			
Rorippa palustris ssp. palustris	Bog Yellowcress			
Sagittaria sanfordii	Sanford's Arrowhead		SSC	CRPR - 1B.2
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Schoenoplectus acutus ssp. occidentalis	Hardstem Bulrush			
Sequoia sempervirens	Coast Redwood			
Sidalcea calycosa ssp. calycosa	Annual Checker-mallow			
Tuctoria greenei	Green's Awnless Orcutt Grass	Endangered	Rare	CRPR - 1B.1
Wolffia columbiana	Columbian Watermeal			
Wolffia globosa	Asian Watermeal			

Notes:
ARSSC = At-Risk Species of Special Concern
BCC = Bird of Conservation Concern
BSSC = Bird Species of Special Concern
CRPR = California Rare Plant Rank
CS = Currently Stable
IUCN = International Union for Conservation of Nature
SSC = Species of Special Concern

Attachment D

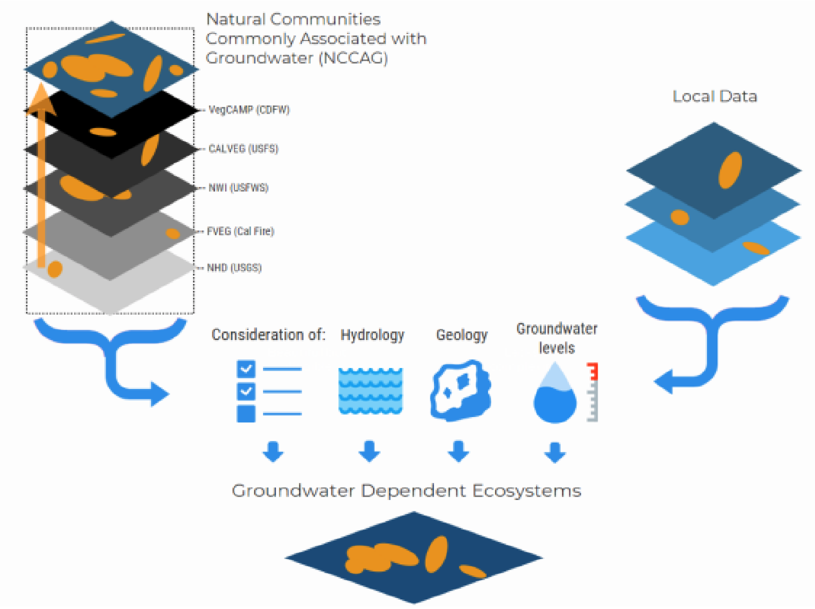
The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[6] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[7]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[6] *NC Dataset Online Viewer:* *https://gis.water.ca.gov/app/NCDatasetViewer/*

[7] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[8]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[9] on the Groundwater Resource Hub[10], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[8] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[9] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[10] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

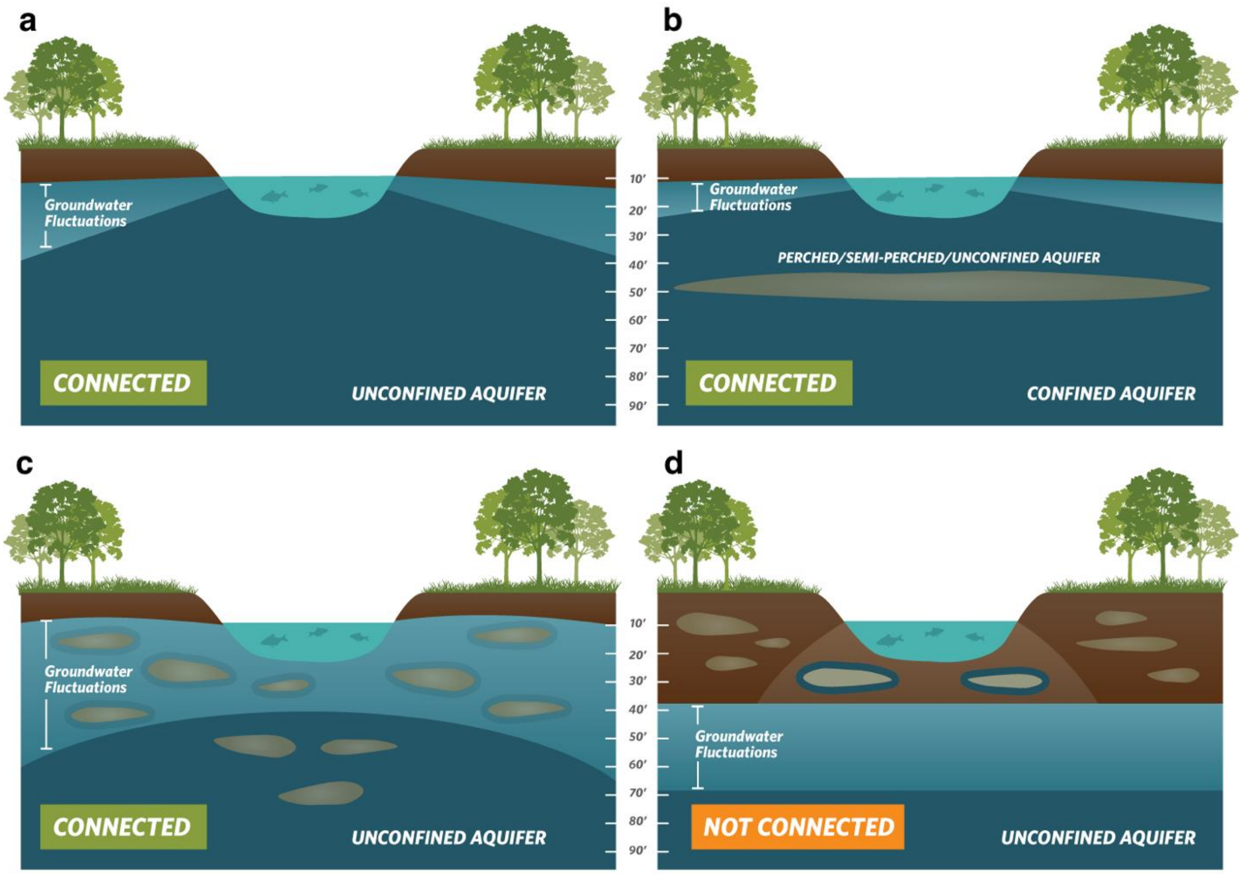

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[11] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[12] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[13] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[14]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

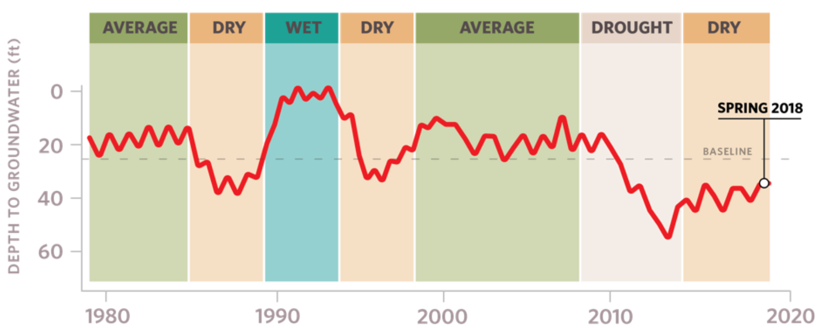

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[11] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[12] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[13] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[14] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[15], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

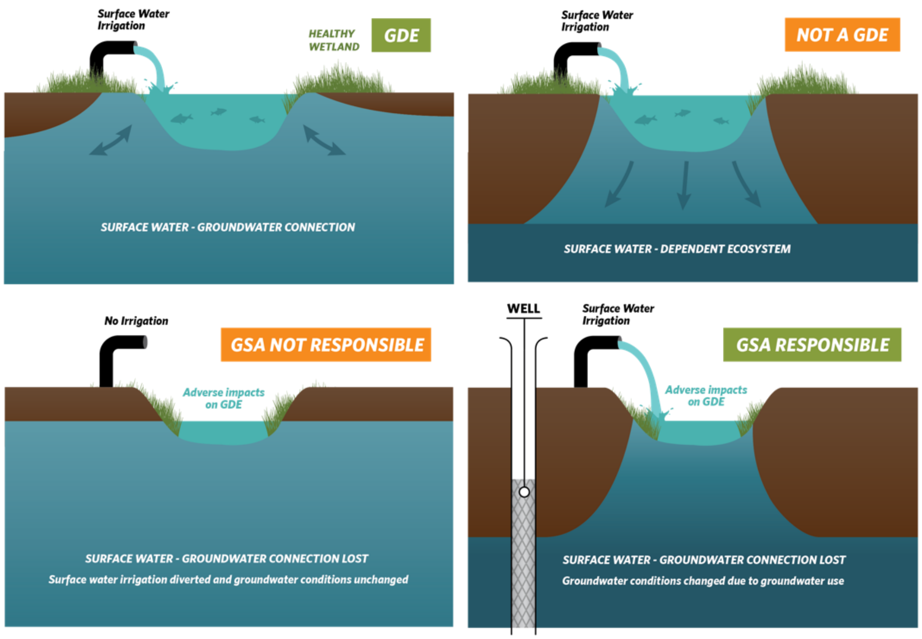

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[15] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

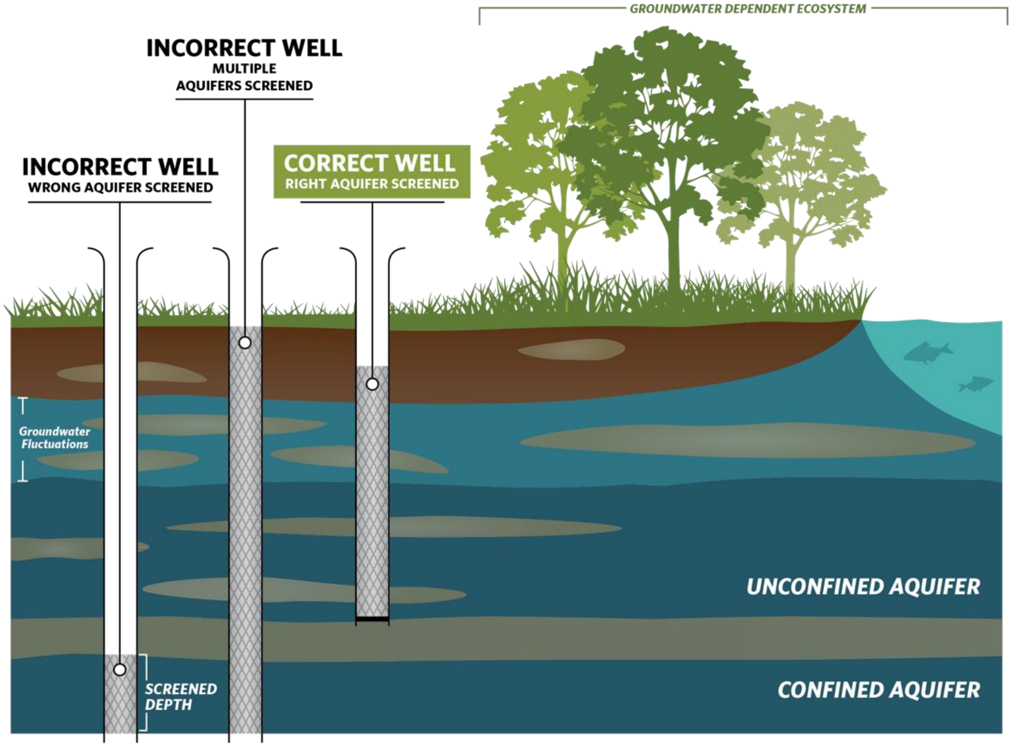

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[16] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

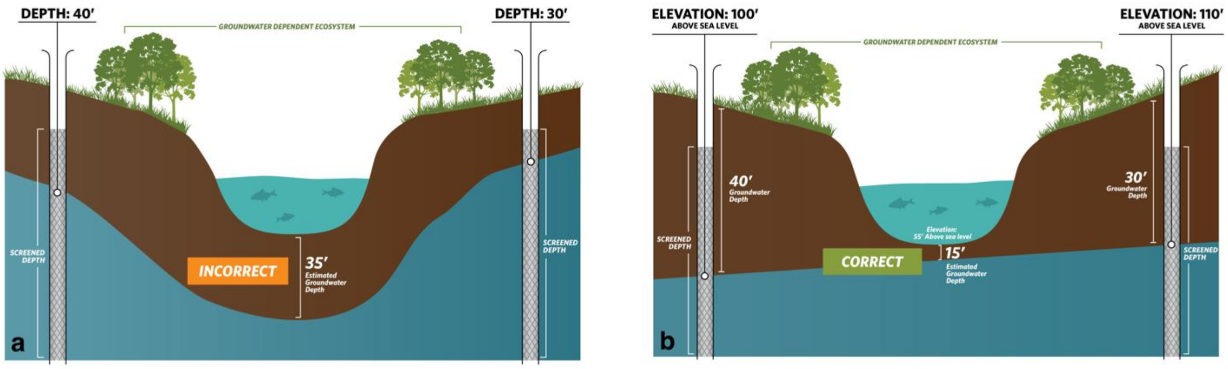

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

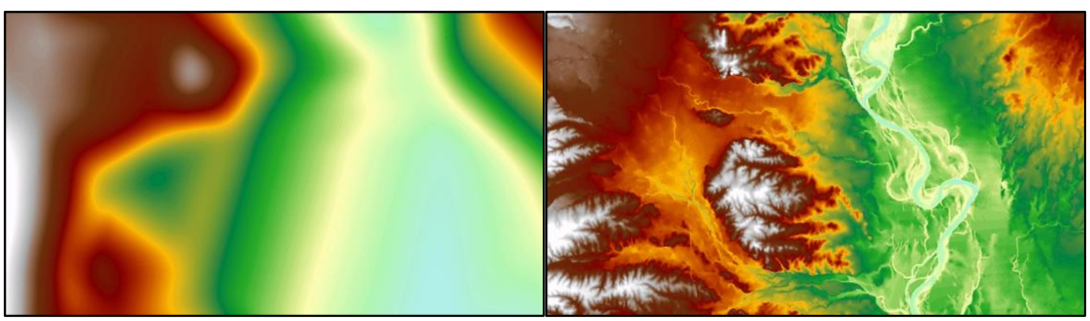

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[16] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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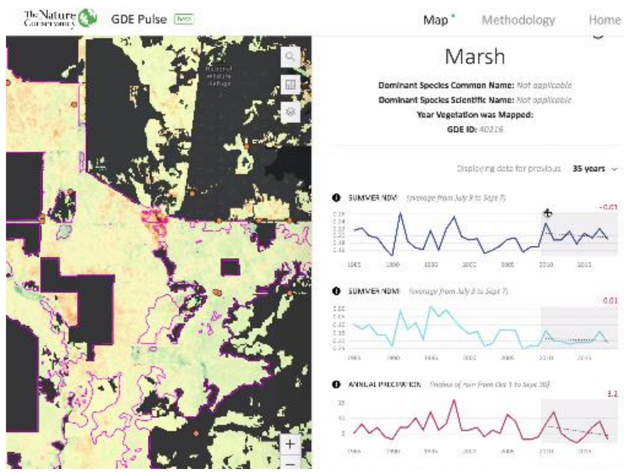
Visit
https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[17]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[18]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[17] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[18] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F

The GSA's Response to TNC Comments on Draft GSP is located on the DWR's SGMA portal as Part 2 of 2.

Attachment G

Mapping Likely Interconnected Surface Water

The Nature Conservancy, California, May 2020

Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, these water features are called ISW is defined as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:

The groundwater elevation data, available for Spring 2011-2012, and Spring and Fall 2013-2018, comes from the California Department of Water Resources (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). These data are represented as continuous raster layers that approximates "feet above or below mean sea level" based on groundwater well measurements. According to the documentation online, groundwater level measurements were selected based on measurement date and well construction information (where available) and are intended to approximate the groundwater levels in the unconfined to uppermost semi-confined aquifers. Each of the raster layer has a different extent, but all of them are limited to the Central Valley. To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

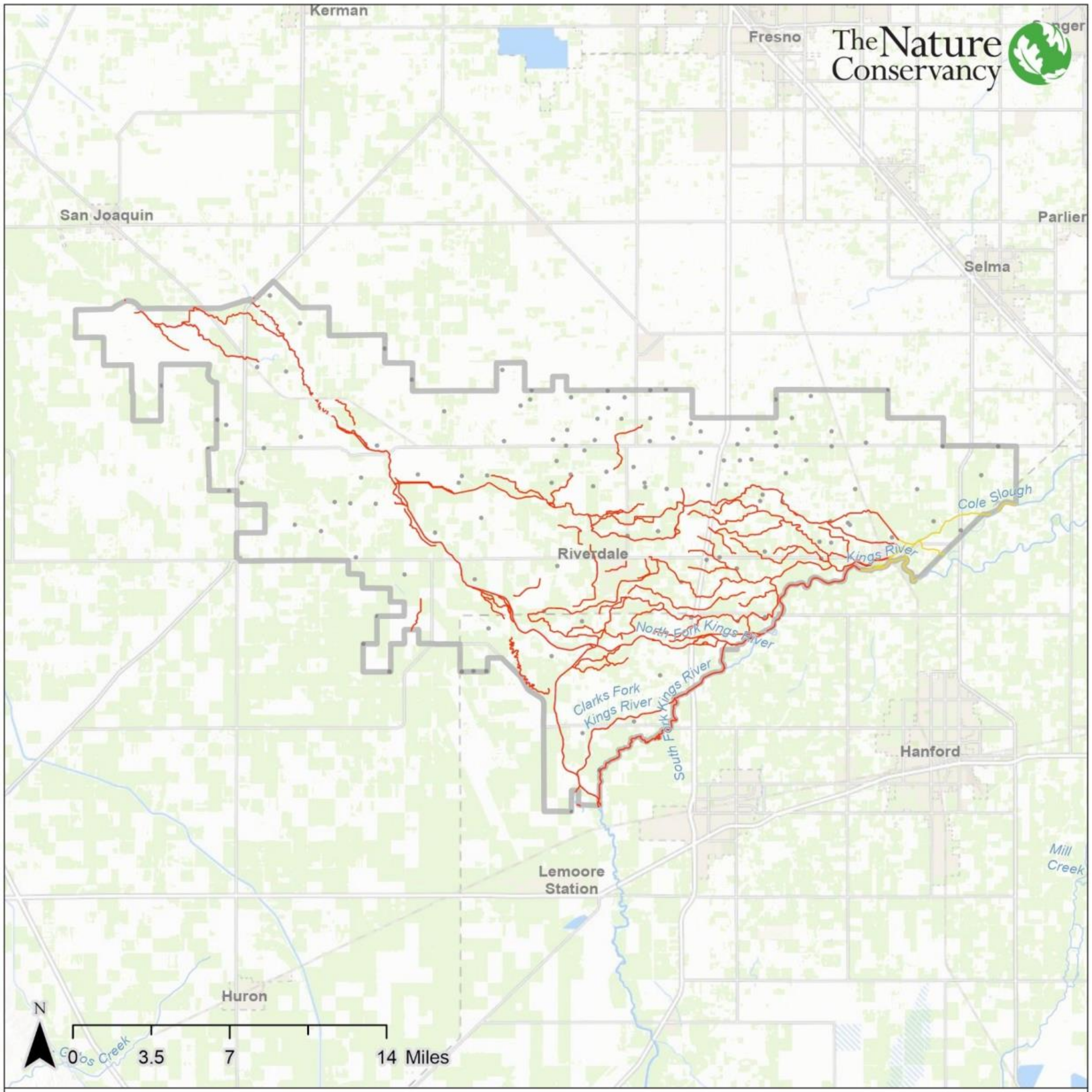
The map splits groundwater depth into four categories:

- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.
- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.

Interconnected Surface Water: Minimum Groundwater Depth (2011-2018)

North Fork Kings GSA GSP



Legend

- Groundwater Sustainability Agency (GSA)
- No groundwater depth data available
- Rivers and streams with no depth data (0 miles)
- Groundwater Elevation Monitoring Point

Minimum Groundwater Depth

- Connected - Gaining: Groundwater at or above stream surface (0 miles)
- Connected - Losing: Groundwater within 20 feet of stream surface (0 miles)
- Uncertain*: Groundwater within 20-50 feet of stream surface (11.9 miles)
- Likely Disconnected*: Groundwater greater than 50 feet below stream surface (227.6 miles)

Streams could be connected to riparian or perched aquifers or shallow aquifers that are poorly characterized. More data are needed to confirm disconnected status.

5-022.08_Kings_NorthForkKings

Data Sources:
CA Dept. of Water Resources Groundwater Elevation Data, gis.water.ca.gov/app/gicima/
NHD Plus V2 Streams, nhdplus.com/NHDPlus/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[19]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[20]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[21] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[19] https://www.ncbi.nlm.nih.gov/pubmed/12753220
[20] Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009
[21] Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015

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May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: North Kings Groundwater Sustainability Plan (GSP), Kings Subbasin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the North Kings Groundwater Sustainability Agency's (GSA's) North Kings Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing sustainable groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be insufficient in addressing environmental beneficial uses and users.

The identification of environmental beneficial users, as well as their consideration when establishing the sustainability goal, undesirable results, minimum thresholds and measurable objectives were insufficient (23 CCR §355.4(b)(4)) and lacked best available science (23 CCR §355.4(b)(1)). In the face of existing, severe overdraft, the GSP would allow groundwater management to largely ignore potential impacts to environmental beneficial users. This could result in irreparable harm to these beneficial users, undermining the intent of SGMA to achieve sustainability.

Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address within 180 days. In these cases, we strongly recommend that the Department, at a minimum, set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update. Should the treatment of environmental beneficial users be indicative of the quality of the overall plan, then we recommend the Department deem the plan inadequate.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides the GSA's response to TNC's comments on the Draft GSP. Attachment G provides a map and method summary of potential ISWs.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We are disappointed to see the feedback that we provided on the draft GSP has been ignored in the final plan, as only 1 out of 57 of our comments were adequately addressed in the Final GSP. This indicates poor engagement of environmental beneficial users, which undermines the intent of SGMA to ensure that sustainability be defined locally with the participation of all users. Based on our experience the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan" (23 CCR §355.4(b)(10)).

TNC recommendation: We strongly recommend that DWR require the GSA to prioritize stakeholder engagement through improvements to their stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters (ISWs) – The GSP incorrectly excluded potential and/or actual ISWs because the plan did not employ the best available science. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). ISWs were incorrectly excluded based on automatically characterizing losing streams as disconnected. This justification for removal was not substantiated with further data or analysis. The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. Our analysis of groundwater levels from 2011 to 2018 indicate extensive areas of ISW in the GSP, including most of the San Joaquin River along the northern border of the GSA and other smaller stream west of Fresno (see Attachment G). Therefore, potential ISWs are not being managed in the GSP.

Map and Assessment of potential ISWs:
By combining multiple years and seasons of groundwater depth data, The Nature Conservancy has determined that within the North Kings GSP, 22.8 river miles are gaining, 31.9 are losing, and the rest are uncertain or likely disconnected (based on streams with available groundwater depth data). Attachment G contains a one-page method summary and a GSP-specific map of ISWs. The interconnected surface water displayed on the map is based on the

minimum groundwater depth estimated by the California Department of Water Resources between 2011 and 2018.

Note: In most cases, the groundwater depth data used to generate the ISW map does not include perched aquifers. As such, some streams marked as disconnected could in actuality, be connected.

TNC recommendation: Until a disconnection can be proven, TNC recommends that the GSP include all potential and confirmed ISWs. We recommend that the GSA conduct a thorough analysis of existing data on surface water-groundwater interconnectivity and estimate the quantity and timing of streamflow depletions in the subbasin. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 1,959 acres of potential GDEs occur in the GSA boundary. TNC developed the *Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs*[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

The plan does not adequately identify, map and consider GDEs. We believe that this does not meet plan evaluation criteria (1), (4) and (10), as defined in the 23 CCR §355.4(b). In addition, the Plan does not satisfy the requirement to identify GDEs (23 CCR §Section 354.16(g)) and consider beneficial users throughout the plan. Our review found that NC Dataset polygons were improperly removed from the GDE map based on groundwater levels that were greater than 30-feet at a single point in time. This is a technically incorrect approach since groundwater levels fluctuate over seasonal and interannual time scales due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Justifying the removal of NC dataset polygons solely based on this criterion does not acknowledge that groundwater levels temporally vary and the fact that many plant species within GDEs can access groundwater depths beyond 30-ft or have adapted water stress strategies to deal with intermittent periods of deep groundwater levels. Using this methodology disregards groundwater fluctuations and can leave many GDEs unprotected in the GSP.

TNC recommendation: TNC recommends that the GSA utilize groundwater levels that represent interannual and inter-seasonal variability along with additional information provided in Attachment D which provides best practices for using the NC dataset to identify and consider GDEs throughout the GSP. Specifically, the GSA should use a Digital Elevation Model (DEM) when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment D.

Water Budget – We were disappointed to see that the water budget did not include the current, historical and projected demands of native vegetation and managed wetlands, as required under SGMA (23 CCR §354.18(a) and (b)(3)). The GSP only focused on a subset of water use sectors, including urban and agricultural users of groundwater. This is problematic because key environmental uses of groundwater are not being accounted for as water supply

[1] *Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf*

decisions are made using this budget nor will they likely be considered in project and management actions.

TNC recommendation: As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

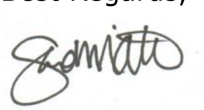
TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. As a result, the monitoring network does not adequately characterize GDEs and other environmental beneficial users of surface water and groundwater. Potential GDEs are located along surface water bodies where no further shallow groundwater monitoring is proposed, leaving recognized data gaps unfilled. Potential ISWs have been dismissed in the GSP, without proposed recommendations to improve ISW identification, mapping, and estimates of depletions. Therefore, GDEs and ISWs are not being specifically addressed by the monitoring network in the GSP.

TNC recommendation: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess potential impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but sustainable groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,



Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

<table>
<tr><th colspan="2">GSP Plan Element*</th><th>GDE Inclusion in GSPs: Identification and Consideration Elements</th><th>Check Box</th></tr>
<tr><td>Admin Info</td><td>2.1.5 Notice & Communication
23 CCR §354.10</td><td>Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.</td><td>1</td></tr>
<tr><td rowspan="3">Planning Framework</td><td rowspan="3">2.1.2 to 2.1.4 Description of Plan Area
23 CCR §354.8</td><td>Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.</td><td>2</td></tr>
<tr><td>Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.</td><td>3</td></tr>
<tr><td>Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs</td><td>4</td></tr>
<tr><td rowspan="7">Basin Setting</td><td rowspan="3">2.2.1 Hydrogeologic Conceptual Model
23 CCR §354.14</td><td>Basin Bottom Boundary:
Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?</td><td>5</td></tr>
<tr><td>Principal aquifers and aquitards:
Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?</td><td>6</td></tr>
<tr><td>Basin cross sections:
Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?</td><td>7</td></tr>
<tr><td rowspan="4">2.2.2 Current & Historical Groundwater Conditions
23 CCR §354.16</td><td>Interconnected surface waters:</td><td>8</td></tr>
<tr><td>Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).</td><td>9</td></tr>
<tr><td>Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.</td><td>10</td></tr>
<tr><td>Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).</td><td>11</td></tr>
</table>

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
North Kings Groundwater Sustainability Plan
Comments based on Draft and Final GSPs

The North Kings Groundwater Sustainability Plan (NKGSP) adopted November 21, 2019 was reviewed by TNC. Public draft GSP comments and responses, provided as Appendix 2E of the GSP, were reviewed and are referred to below. The TNC comments and responses are also provided in Attachment F of this letter. This attachment lists our original comments on the complete public draft GSP as submitted to the GSA during the public comment period, and states whether or not they were addressed in the final GSP [as green text in brackets]. Comments are provided in the order of the checklist items included as Attachment A.

<u>Checklist Item 1 - Notice & Communication (23 CCR §354.10)</u>

[Section 2.5.1 Description of Beneficial Uses and Users (p. 2-35)]

- *[The GSA's response of "Thank you for your comments. All comments are given due consideration" does not address our comment and no changes to GSP text were made.]* Environmental and Ecosystem Interests were listed as Beneficial Users of groundwater. Surface water users were also listed as Beneficial Users, as long as there is hydrologic connection between surface water and groundwater bodies. No further description of the environmental or ecosystem interests or surface water users was given. The Kings River Fisheries Program and the San Joaquin River Restoration Program (SJRRP) are described in Section 2.2.2 (Impacts to Operational Flexibility). The Kings River program includes year-round flows, improved temperature control, and monitoring requirements. The SJRRP program also increases flows to benefit fisheries. The benefits and requirements of these programs should be discussed here. **Please describe whether other beneficial uses and users of groundwater in the NKGSA area are present, including protected Lands, preserves, refuges, conservation areas, recreational areas; managed wildlife areas, and other protected lands; and Public Trust Uses, including wildlife, aquatic habitat, fisheries, and recreation.**
- *[The GSA's response does not address our comment and no changes to GSP text made.]* The types and locations of environmental uses, species and habitats supported, and the designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the NKGSA area should be specified. **To identify environmental uses and users, please refer to the following:**
  - Natural Communities Commonly Associated with Groundwater dataset (NC Dataset) - https://gis.water.ca.gov/app/NCDatasetViewer/
  - The list of freshwater species located in the Kings Subbasin in Attachment C of this letter. Please take particular note of the species with protected status.
  - CDFW's CNDDB - https://www.wildlife.ca.gov/Data/CNDDB
  - USFWS's IPAC report for the NKGSA area -https://ecos.fws.gov/ipac/

Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8)

[Section 2.2.1 Monitoring and Management Programs (pp. 2-16 to 2-17)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* Groundwater Level Monitoring (p. 2-16) programs have been implemented by the Fresno Irrigation District since 1920. They collect data from other irrigation districts and agencies and prepared annual reports. Most of the agencies within the North Kings GSP were formerly part of the Fresno Area Regional Groundwater Management Group. The Kings River Conservation District (KRCD) also collects water level data in the NKGSA area. **Please describe how existing groundwater monitoring programs are protective of GDEs or propose additional monitoring that specifically targets GDEs.**
- *[The GSA's response does not address our comment and no changes to GSP text made.]* The Surface Water Monitoring section (p. 2-17) briefly describes the types of monitoring by the Fresno Irrigation District, Kings River Water Association (KRWA), the Friant Water Authority, the cities of Fresno and Clovis, and other water districts. There is no mention of ISWs or GDEs and how they are monitored. **Please explain the relationship of existing stream flow monitoring to the protection of ISWs and GDEs.**

[Section 2.2.2 Impacts to Operational Flexibility (pp. 2-18 to 2-23)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* The SJRRP requires the release of flows from Friant Dam to the confluence with the Merced River to support the life-stages of salmon and other fish. These restoration flows will allow more groundwater seepage when the system is fully operational, which is estimated to be after 2029. Table 2-3 (p. 2-22) lists potential impacts in reduced water deliveries from the San Joaquin River. This section should discuss or reference any instream flow requirements, especially flow needs for critical species, including the amount, time of year when the flow minimum is specified, the duration, the species for which it applies, associated permits that set forth the requirements, and the regulating agency setting forth the compliance requirements. **Please discuss the potential impact of the SJRRP on the aquatic species and habitat present along the river and within adjacent habitats supported by the river.**

[Section 2.3 Relation to General Plans (pp. 2-24 to 2-28)]

- *[The GSA's response does not address our comment. Minor changes to GSP text do not adequately address our comment.]* There are three city general plans (Fresno, Clovis, and Kerman) and the Fresno County General Plan within the NKGSA area. All were completed prior to the development of the GSA. The plans should be modified to include a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals. **Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and**

procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs.

- *[The GSA's response does not address our comment and no changes to GSP text made.]* This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the NKGSA area and if they are associated with critical habitat, GDE or ISW habitats. **Please identify all relevant HCPs and NCCPs within the NKGSA area and address how GSP implementation will coordinate with the goals of HCPs or NCCPs.**
- *[The GSA's response does not address our comment and no changes to GSP text made.]* Please refer to the Critical Species Lookbook[2] to review and discuss the potential groundwater reliance of critical species in the basin. **Please include a discussion regarding the management of critical habitat for these aquatic species and their relationship to the GSP.**

[Section 2.3.4 Permitting New or Replacement Wells (p. 2-27 to 2-28)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* **Please include a discussion of how future well permitting will be coordinated with the GSP to ensure achievement of the Plan's sustainability goals.**
- *[The GSA's response does not address our comment and no changes to GSP text made.]* The State Third Appellate District recently found that counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF v. SWRCB and Siskiyou County, No. C083239). **The need for well permitting programs to comply with this requirement should be stated in the text.**

[Section 2.4.4 Well Abandonment/Well Destruction Program (p. 2-32)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* The County of Fresno has the authority to require permits for well abandonment and/or well destruction, but due to staffing and funding limitations the GSP notes that enforcement of this requirement is limited. The Cities of Clovis and Fresno also require that wells be properly destroyed within their city limits. **Please describe what actions will be taken by the NKGSA to make sure that wells are properly abandoned.** The GSP also states that well owners will be encouraged to convert the wells into monitoring wells. **Please include text to clarify that only wells screened in one aquifer and are appropriate for monitoring will be included in the monitoring program.**

Checklist Items 5, 6, and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 3.1.7 Cross-sections (p. 3-14)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* Basinwide cross sections provided in Figures 3-7 through 3-12 (pp. 3-15

[2] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

through 3-20) are regional, and do not include a graphical representation of the manner in which shallow groundwater may interact with ISWs or GDEs that would allow the reader to understand this topic. The cross-sections have been taken from a 1969 source and as reproduced in the GSP, are very difficult to read and understand. **Please reproduce the regional cross-sections so that they can be understood by the reader and update them to illustrate data obtained from more recent well installations. Include an example near-surface cross section that depicts the conceptual understanding of shallow groundwater and river interactions at different locations, as well as any potential GDEs**.

[Section 3.1.8.1 Geologic Formations (p. 3-21 to 3-22)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* The first aquitard is the extensive iron-silica hardpan layer of the Riverbank Formation, which is important in identifying where groundwater recharge can occur. The text states later in this section that the two clay layers, A and C clays are not present in the NKGSA area (p. 3-22). The E-clay, commonly known as the Corcoran Clay, is present in the western part of the NKGSA area and confined conditions exist below the Corcoran Clay. In the past, it was assumed that only one aquifer existed in the eastern part where the E-clay is absent. However, this assumption is being reevaluated. KDSA has described in Appendix 3A how locally extensive clay layers can function as an aquitard, forming a confined aquifer below. This evaluation will continue and NKGSA stated later in Section 5 that the confined aquifer may be monitored separately in the future. **Please discuss the importance of clearly defining which aquifer any given well is monitoring. Wells monitoring the unconfined aquifer measure the true water table and these elevations should be contoured separately. These groundwater elevations then help determine representative conditions within GDE units.**

[Section 3.1.8.2 Aquifer Characteristics and Properties (p. 3-26)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* In the NKGSA area, the base of the usable aquifer corresponds with the base of freshwater, generally defined as groundwater with total dissolved solids (TDS) of 2,000 milligrams per liter (mg/l) (KDSA, 2010), except one area to the east. In the far eastern part of the NKGSA area, the base of the aquifer is defined by the top of the basement complex. As noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** Properly defining the bottom of the basin will prevent the possibility of extractors with wells deeper than the basin boundary from claiming exemption from SGMA due to their well residing outside the vertical extent of the basin boundary.

[Section 3.1.12 Recharge and Discharge Areas (pp. 3-38 to 3-42)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* Wetlands were mapped along the Kings river, San Joaquin River, and several intermittent streams including Redbank Creek, Dog Creek, Pup Creek, and Big Dry Creek, as shown on Figure 3-22 (p. 3-43) as identified from US Forest Service's Wetland Inventory, according to the GSP. **In this section, please refer to the discussion of GDEs in Section 3.2.8 and mapped on Figure 3-40. Also, if the Wetland Inventory was in fact the US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI), then correct the text and reevaluate the data. The NWI does not always include or segregate separate existing wetlands that are on the periphery of other features. Please describe the wetland types in more detail. If they are truly vernal pools confined by a clay layer then they are not GDEs, but they must meet the criteria of a vernal pool as described by the California Rapid Assessment Methodology or the United States Army Corps of Engineers to qualify.**

[Section 3.2.1 Groundwater Level Data (pp. 3-44 to 3-49)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* The NKGSP notes that "The dramatic lowering of hydraulic heads in the confined parts of the aquifer has resulted in a large net downward movement of water through boreholes. This vertical flow occurs in both pumped and un-pumped wells during the growing season" (Faunt, CC ed. 2009) (p. 3-47). Vertical gradients have been measured recently indicating that there are head differences between wells screened above and below the Corcoran Clay in several locations. **Please refer to a map in this section to show the locations where the vertical gradients have been measured. Please expand this section to include a discussion of the impacts of vertical flow on ISWs and GDEs.**

<u>Checklist Items 8, 9, and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)</u>

[Section 3.2.7 Surface Water and Groundwater Interconnection (pp. 3-76 to 3-80)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* ISWs are best estimated by first determining which reaches are completely disconnected from groundwater. This approach would involve comparing groundwater elevations with a land surface Digital Elevation Model (DEM) that could identify which surface waters have groundwater consistently below surface water features, such that an unsaturated zone would separate surface water from groundwater. **Please provide or refer to depth to groundwater contour maps in this section. See Attachment D for best practices for completing this step. Specifically, ensure that the first step is contouring groundwater elevations, and the subtracting this layer from land surface elevations from a DEM to estimate depth to groundwater contours across the landscape**. This will provide much more accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

Contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make.

- *[The GSA's response does not address our comment and no changes to GSP text made.]* The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". This GSP states that "the location specific data from the SJRRP indicate that there may be connection at some locations. Limited data is available from the DWR from shallow wells on ISW systems along the Kings River where it borders the NKGSA boundary" (p. 3-75). The locations along the San Joaquin River, where shallow wells are available (Figure 3-37, p. 3-77), are described, indicating that the river may be connected during times of high flows. No graphs were included to show the relationship between the depth to groundwater and the river bed. **Please provide cross-sections at these locations to show the relationship between the depth to groundwater and the bed of the river channel.**
- *[The GSA's response does not address our comment and no changes to GSP text made.]* Near the Kings River between Highway 180 and Sanger, shallow wells were installed at proposed gravel processing facilities and wastewater facilities by KDSA (KDSA 2017). The GSP states that the "KDSA further indicates that along the reach of the Kings River, upstream of the Reedley narrows, the groundwater is indicated to be in direct hydraulic communication with streamflow in the Kings River" (p. 3-79). The groundwater in this area is shallow based on DWR measurements. This finding needs to be illustrated using cross-sections with measured channel bed elevations and depths to groundwater. **Again, please provide a cross-section at this location to show the relationship between the depth to groundwater and the bed of the river channel.**

<u>Checklist Items 11 to 15, Identifying and Mapping GDEs (23 CCR §354.16)</u>

[Section 3.2.8 Groundwater Dependent Ecosystems (p. 3-81)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* The NC dataset is a starting point for GSAs to identify GDEs in their basin/subbasin. The NC dataset has 1,959 acres of potential GDEs mapped within the NKGSA area, representing a significant amount of GDEs to be considered. Note that this is a starting point and not all potential GDEs are mapped and not all ecosystems mapped are GDEs. **Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled by the monitoring network**. Specifically, please note:
    - *[The GSA's response does not address our comment and no changes to GSP text made.]* Figure 3-23 provides groundwater depth contours for Spring of 2017. **Please provide more details on how this figure was developed by confirming**:

    - that wells monitoring the upper unconfined aquifer are being used to verify whether polygons in the NC dataset are supported by groundwater;
    - the wells used for interpolating depth to groundwater sufficiently close (<5km) to NC Dataset polygons reflect local conditions relevant to ecosystems;
    - the wells used for interpolating depth to groundwater are screened within the surficial unconfined aquifer and capable of measuring the true water table; and
    - depth to groundwater is contoured using groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a DEM to estimate depth to groundwater contours across the landscape. This will provide much more accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from measurements at wells assume that the land surface is constant, which is a poor assumption to make. It is better to assume that water surface elevations are constant in between wells, and then calculate depth to groundwater using a DEM of the land surface to create the contour map.
- *[The GSA's response does not address our comment and no changes to GSP text made.]* It is highly advised that seasonal and interannual groundwater fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one point in time (e.g., Spring 2017) can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. **We highly recommend using depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. Ensure that groundwater condition data prior to the SGMA benchmark date of January 1, 2015 is included in the analysis. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network**.
- *[The GSA's response does not address our comment and no changes to GSP text made.]* **Please provide rationale for the 30-foot criteria cited in the text.** The text states (p. 3-81): "Recognizing that much of the Kings Subbasin has a depth to groundwater greater than the deepest vegetative GDE rooting depth of thirty feet, many of the GDEs identified in the NC Dataset Viewer were mischaracterized." In TNC's GDE Guidance, the depth criteria of 30 feet is presented as a criterion for *inclusion*, not a standalone criterion for *exclusion*. In other words, if groundwater is within 30 feet of the

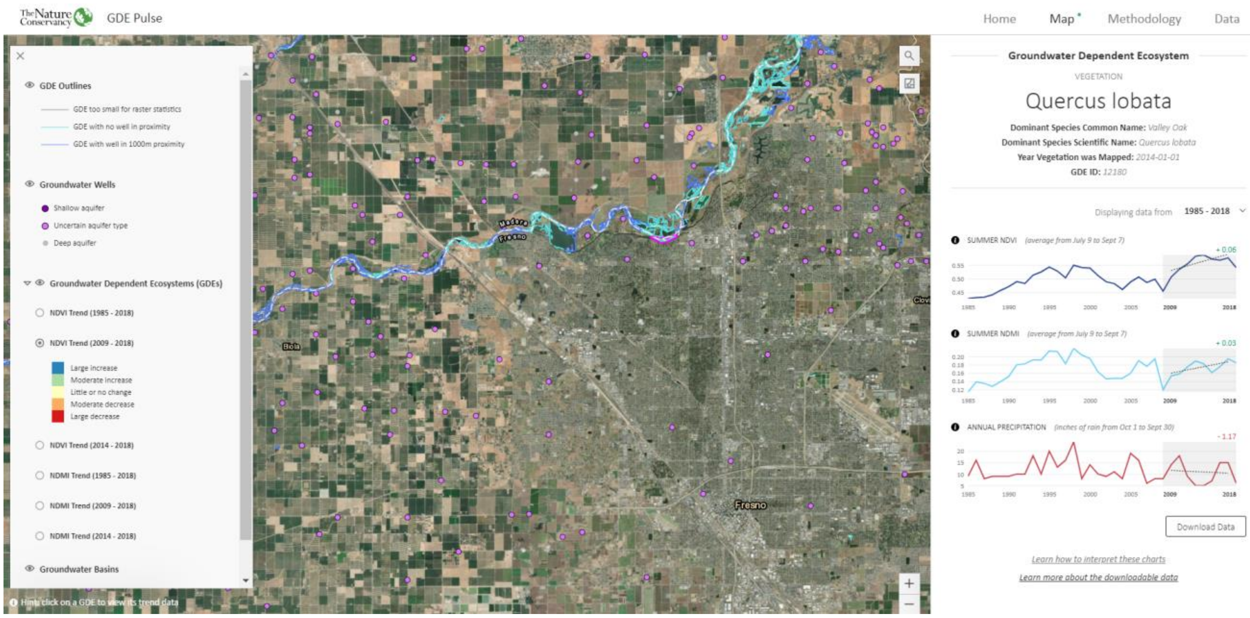
ground surface, then a GDE can be identified. If it is not, then further analysis must be conducted (see Appendix III of the GDE Guidance). **Please indicate what vegetation is present in all NC dataset polygons.** The actual rooting depth of vegetation growing in the area should be considered, and this will vary by species dominance and habitats present. For example, some phreatophytes can root to 120-feet deep in more arid and drought stressed environments. Furthermore, rooting depths are likely to spatially vary based on the local hydrologic conditions available to the plant. Maximum rooting depths do not take capillary action into consideration, which will vary with soil type and is an important consideration since woody phreatophytes generally do not like to have their roots submerged in groundwater for extended periods of time, and hence can access groundwater at deeper depths.

  - *[One sentence added to GSP text: "This 100-ft buffer is based on a California Department of Transportation typical wetland setback (CDOT, 2019)." However, this addition to the text does not address our comment, nor does this buffer rule describe whether groundwater conditions in the basin are supporting GDEs.]* The text states: "The Kings Subbasin also categorized GDEs within 100 feet of the Kings River and the San Joaquin River as "Possible GDEs." **Please clarify how the 100-foot buffer was used to include or exclude GDEs in the NKGSA area, and how this is supported by groundwater level and plant physiological data. If there is a potential GDE near the river, we recommend that the entire GDE be included, rather than using an arbitrary 100-foot cutoff.**

<u>Checklist Items 16 to 20, Describing GDEs (23 CCR §354.16)</u>

[Section 3.2.8 Groundwater Dependent Ecosystems (p. 3-81)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* **Please provide information on the historical or current groundwater conditions in the GDEs or the ecological conditions present**. Refer to GDE Pulse (https://gde.codefornature.org; See Attachment E of this letter for more details) or any other locally available data (e.g., leaf area index, evapotranspiration or other data) to describe depth to groundwater trends in and around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found within the NKGSA area:



- *[The GSA's response does not address our comment and no changes to GSP text made.]* **Please provide an ecological inventory (see Appendix III, Worksheet 2 of the GDE Guidance) for all potential GDEs that includes the vegetation types or habitat types and rank the GDEs as having a high, moderate or low value; and what characterizes the rank.**
- *[The GSA's response does not address our comment and no changes to GSP text made.]* **Please identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat were found or are expected to occur within any of the GDEs**. The list of freshwater species located in the Kings Subbasin can be found in Attachment C of this letter.
- *[The GSA's response does not address our comment and no changes to GSP text made.]* **For each identifiable GDE unit with supporting hydrological datasets please include the following:**
  - Plot and provide hydrological datasets for each GDE.
  - Define the baseline period in the hydrologic data.
  - Classify GDE units as having high, moderate, or low susceptibility to changes in groundwater.
  - Explore cause-and-effect relationships between groundwater changes and GDEs.
- *[The GSA's response does not address our comment and no changes to GSP text made.]* **For each identifiable GDE unit without supporting hydrological datasets please describe data gaps and / or insufficiencies.**
- *[The GSA's response does not address our comment and no changes to GSP text made.]* **Compile and synthesize biological data for each GDE unit by including:**
  - Biological datasets for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.
  - Describe data gaps and insufficiencies.

- *[The GSA's response does not address our comment and no changes to GSP text made.]* **Provide a description of the potential effects on GDEs, land uses, and property interests, including:**
    - Cause-and-effect relationships between GDE and groundwater conditions.
    - Potential impacts to GDEs that are considered to be "significant and unreasonable".
    - Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters, critical habitat constraints, etc.) for significant impacts to relevant species or ecological communities.
    - Land uses that and consider recreational uses (e.g., fishing/hunting, hiking, boating, etc.).
    - Property interests, such as privately and publicly protected conservation lands and opens spaces, wildlife refuges, parks, and natural preserves.

<u>Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)</u>

[Section 3.3.6 Outflows from Groundwater System (p. 3-95)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* "Confined groundwater outflows were not calculated due to a lack of confined groundwater level information in NKGSA" (p. 3-99). This is a significant data gap. The confined outflow was estimated as 35,000 acre-feet per year (AF/year) based on data for other parts of the Kings Basin, compared to the total estimated outflow of 122,000 AF/year. **Please expand on how this data gap will be filled in the proposed monitoring program described in Section 5.**

[Section 3.3.8 Historical Water Budget (p. 3-101)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* **Please clarify whether a term is included for native or riparian vegetation evapotranspiration and for wetlands in the North Kings historical, current, and future water budgets.**
- *[The GSA's response does not address our comment and no changes to GSP text made.]* The groundwater outflow to McMullin GSA was estimated by comparing the flow before development in the 1920's to the present. The induced outflow was estimated to be 43,000 AF from the North Kings GSA to McMullin GSA (p. 3-102). This amount is stated as included in the historical water budget but not in future water budgets, since McMullin is expected to mitigate this imbalance from 2020 to 2040. However, the historical, current, and 2040 budgets had the same groundwater outflow of 122,000 AF/year. This seems inconsistent with the statement in the text. **Please revise or clarify the text as necessary.**

[Section 3.3.10 Projected Water Budget (p. 3-109)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* The Friant Water Authority estimated climate change impacts on the San Joaquin River using the Water Storage Investment Program (WSIP) data sets. "In general, the data showed a slight reduction in future supplies" (p. 3-112). Given the uncertainty associated with the Kings River supplies in the future, the assumption was made that the historical water delivery from the Kings River would be maintained. **Please consider using the WSIP data to discuss potential impacts to groundwater conditions due to climate change on GDEs and aquatic ecosystems.**

Checklist Items 23 to 25 – Sustainability Goal (23 CCR §354.24)
[Section 4.1 Sustainability Goal (p. 4-2)] The Sustainability Goal does not consider GDEs or ISWs.

- *[Neither the GSA's response nor minor changes made to the GSP text adequately addresses our comment.]* **Since GDEs are likely present in the NKGSA area (see comments under Checklist Items 16-20) they should be recognized as beneficial users of groundwater and should be included in the Sustainability Goal. In addition, a statement about any intention to address pre-SGMA impacts should be included.**
- *[Neither the GSA's response nor minor changes made to the GSP text adequately addresses our comment.]* The Plan states that there are ISWs along the Kings River. In addition, there are multiple small creeks including Big Dry Creek, Pup Creek, Dog Creek, Redbank Creek, and Fancher Creek that may have ISWs. Further evidence that supports the presence of ISWs along these water courses include Figure 3-40 (p. 3-82) that identifies potential GDEs, and the depth to water measurements in wells for spring 1997 and 2012 presented in Appendix 3A (Technical Memorandum 4 Attachment 3). **Please identify and describe all ISWs for these areas and include them in the GSP.**
- *[Neither the GSA's response nor minor changes made to the GSP text adequately addresses our comment.]* GDEs are dependent, in part, on suitable water quality; however, the GSP only considers water quality for irrigation and domestic use. **TNC recommends including ISWs and their potential GDEs in the sustainability goal and criteria. Since GDEs may be affected by water quality, they should be included in the Sustainability Goal.**

Checklist Item 26 – Measurable Objectives (23 CCR §354.30)

[Sections 4.2.3 Measurable Objectives for Groundwater Levels (p. 4-18)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* This Measurable Objective does not consider GDEs. GDEs are often adjacent to streams or associated with riparian corridors where ISWs exist, even if only seasonally or discontinuously along a longitudinal or lateral profile. **Please include GDEs (see comments under Checklist Items 8-10) in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Sections 4.5.3 Measurable Objectives for Water Quality (p. 4-39)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* This Measurable Objective does not consider water quality needs of GDEs. **Please include a discussion about GDEs and water quality and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Sections 4.7.3 Measurable Objectives for Interconnected Surface Water and Groundwater (p. 4-72)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* This Measurable Objective does not consider ISWs. **Please include ISWs (see comments under Checklist Items 16-20) in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

<u>Checklist Item 27-29 – Minimum Thresholds (23 CCR §354.28</u>)

[Sections 4.2.2 Minimum Thresholds for Groundwater Levels (p. 4-7)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* This Minimum Threshold does not consider GDEs or ISWs. **Please include GDEs and ISWs in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Sections 4.5.2 Minimum Thresholds for Groundwater Quality (p. 4-33)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* This Minimum Threshold does not consider water quality needs of GDEs. **Please include a discussion about GDEs and water quality and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

[Sections 4.7.2 Minimum Thresholds for Interconnected Surface Water and Groundwater (p. 4-69)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* This Minimum Threshold does not consider GDEs. GDEs are often adjacent to streams or associated with riparian corridors where ISWs exist, even if only seasonally or are discontinuous along a longitudinal profile. **Please include GDEs in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**
- *[The GSA's response does not address our comment and no changes to GSP text made.]* The Plan states that there are time periods of ISWs along the San Joaquin River; however, they are dismissed because they are not continuously connected. ISWs that are not continuously connected spatially and/or temporally are still ISWs

and should not be excluded from this GSP. **Even when ISWs are not continuously connected they should be included in the Minimum Thresholds.**

- *[The GSA's response does not address our comment and no changes to GSP text made.]* The analysis for potential depletion of ISWs in Section 4.7 should include all beneficial uses and users of surface water that could be affected by groundwater withdrawals, including environmental users. The SJRRP identifies instream flow requirements for salmon in Reach 1a and potentially 2a which forms the northern border in the Plan area (http://www.restoresjr.net/about/overview-map/). **Please include instream flow requirements and critical habitat designations in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

Checklist Item 30-46 – Undesirable Results (23 CCR §354.26)

[Section 4.2.1 Undesirable Results for Groundwater Levels (p. 4-3)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* This section only describes undesirable results relating to human beneficial uses of groundwater and neglects environmental beneficial uses and users that could be adversely affected by chronic groundwater level decline. **Please add "potential adverse impacts to GDEs and native freshwater species" to the list of potential undesirable results presented in Section 4.2.**
- *[The GSA's response does not address our comment and no changes to GSP text made.]* The GDE Pulse web application developed by TNC provides easy access to 35 years of remote sensing data to view trends of vegetation metrics, groundwater depth (where available), and precipitation data. This satellite imagery can be used to observe trends for NC dataset polygons within and near the GSA. Over the past 10 years (2009-2018), some NC dataset vegetation polygons have experienced adverse impacts to vegetation growth and moisture along the San Joaquin River and Kings River. An example screen shot from the GDE Pulse tool is presented under Checklist Items 11-15 above.

[Section 4.5.1 Description of Undesirable Results (for degraded water quality) (p. 4-29)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* This section only describes undesirable results in terms of meeting drinking water standards. The following is a link to a paper by Smith, Knight and Fendorf (2018) titled "Overpumping leads to California groundwater arsenic threat": (https://www.nature.com/articles/s41467-018-04475-3). **The section should be modified to state that overpumping and dewatering of aquitards has been identified as a potential source of elevated arsenic concentrations above drinking water standards in San Joaquin Valley aquifers. In addition, any potential undesirable results from degradation of water quality that may impact GDEs and freshwater species in the area should be discussed in this section.**

[Section 4.7.1 Undesirable Results for Interconnected Surface Water and Groundwater (p. 4-57)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* This section does not consider Undesirable Results for ISWs. The Plan states that there are time periods of ISWs along the San Joaquin River; however, they are dismissed because they are not continuously connected. **Even though the ISWs are not continuously connected they should be included in the Undesirable Results.** The analysis for potential depletion of ISWs in Section 4.7 should include all beneficial users of surface water that could be affected by groundwater withdrawals, including environmental. The SJRRP identifies instream flow needs for salmon in Reach 1a and potentially 2a which forms the northern border in the Plan area (http://www.restoresjr.net/about/overview-map/). **Please include instream flow requirements and critical habitat designations in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**

Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)

Note some page numbers are cut off in Section 5. Page numbers refer to page of pdf document.

[Section 5.2 Groundwater Levels (pdf pp. 288 to 302)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* **Please address how the requirement to link and correlate groundwater level declines to biological responses, and significant and adverse impacts to GDEs and ISWs will be addressed by the monitoring network.**
- *[Our comment is adequately addressed through GSP text changes. Thank you for acknowledging that proper characterization of each individual aquifer zone is necessary for protection of beneficial users of groundwater.]* The proposed wells to be used for monitoring groundwater levels in the unconfined aquifer are shown in Figure 5-2 (p. 295). Many of the monitoring wells are missing well construction information. The missing well information is a known data gap and was acknowledged on p. 299. **To accurately characterize GDEs, please clarify how the unconfined aquifer will be monitored and how many wells will be used.**
- *[The GSA's response does not address our comment and no changes to GSP text made.]* The text states that the intent is to monitor the unconfined aquifer at present. "Groundwater level data from wells in the NKGSA will continue to be collected and evaluated to gain a better understanding of whether the confined groundwater conditions east of the Corcoran Clay are present" (p. 290). Wells that monitor the deeper confined or semi-confined aquifer will be added in the future. Monitoring of the confined aquifer may become a separate program in future years. **Please clarify how many of the wells on Figure 5-2 represent the unconfined aquifer.**

[Section 5.7 Depletion of Interconnected Surface Water (pdf pp. 325 to 331)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* The NKGSA intends to use data from wells near the San Joaquin and Kings Rivers in the current monitoring network for depletion of ISWs monitoring. The data obtained by the SJRRP will be reviewed as it becomes available to supplement that well information. The long-term monitoring network shown on Figure 5-2 shows only a few wells that are near rivers and the well depths and screened intervals are not provided. **Please reconcile data gaps in monitoring for ISWs with specific recommendations (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features to improve ISW mapping and inform an adequate analysis.**

Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)
[Section 6.1 Introduction (p. 6-2) and 6.2 Projects (pp. 6-2 to 6-11)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* The NKGSA area includes many GDEs and ISWs (see our comments under checklist items 8-10 and 16-20 above) that are beneficial uses and users of groundwater, and may include potentially sensitive resources and protected lands. Environmental resource protection needs should be considered in establishing project priorities. In addition, and consistent with existing grant and funding guidelines for SGMA-related work, priority should be given to multi-benefit projects that can address water quantity as well as providing environmental benefits or benefits to disadvantaged communities. **Please include environmental benefits and multiple benefits as criteria for assessing project priorities.**

[Section 6.2 Projects (pp. 6-2 to 6-11)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* This Section identifies many important projects; however, the descriptions for these projects only identify benefits to groundwater level and supply. Since maintenance or recovery of groundwater levels, or construction of recharge facilities, may have potential environmental benefits in many cases it would be advantageous to demonstrate multiple benefits from a funding and prioritization perspective.
    - **For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.**
    - If ISWs will not be adequately protected by those listed, **please include and describe additional management actions and projects targeted for protecting ISWs.**
    - Recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such multiple-benefit projects and facilities have been incorporated into local HCPs and NCCPs, more fully recognizing the value of the habitat that they provide and the species they support. For projects that

construct recharge ponds, **please consider identifying if there is habitat value incorporated into the design and how the recharge ponds will be managed to benefit environmental users.**
  - There are wetlands shown on Figure 3-19 (p. 3-37), which include recharge basins of the cities, irrigation districts, wastewater treatment facilities, and flood control district. **Please indicate whether the existing recharge basins are operated (or could be operated) as habitat suitable for migrating birds or other species and could be included in an HCP or NCCP.**
  - For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

[Section 6.3 Management Actions (p. 6-12)]

- *[The GSA's response does not address our comment and no changes to GSP text made.]* This section discusses the Management Actions for GSP implementation and SGMA compliance; however, these actions are focused on meeting groundwater level and supply measures and do not include support for GDEs or ISWs. **Please consider modifying the Management Actions to include education and outreach for protection of GDEs and ISWs, as well as specific management of these ecosystems and the species they provide for.**

Attachment C

Freshwater Species Located in the Kings Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Kings Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[3]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[4] as well as on The Nature Conservancy's science website[5].

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Birds				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	BCC	SCC	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		SCC	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			

[3] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[4] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[5] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya valisineria	Canvasback		SCC	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		SCC	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cypseloides niger	Black Swift	BCC	SCC	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	BCC	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	BCC	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		SSC	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			

Oxyura jamaicensis	Ruddy Duck			
Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		SSC	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		SSC	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		SSC	BSSC - Third priority
Crustaceans				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	SSC	IUCN - Vulnerable
Branchinecta mesovallensis	Midvalley Fairy Shrimp		SSC	
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	SSC	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		SSC	IUCN - Near Threatened
Fishes				
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Cottus asper ssp. 1	Prickly sculpin			Least Concern - Moyle 2013
Cottus gulosus	Riffle sculpin		SSC	Near-Threatened - Moyle 2013
Gasterosteus aculeatus microcephalus	Inland threespine stickleback		SSC	Least Concern - Moyle 2013

Lampetra hubbsi	Kern brook lamprey		SSC	Vulnerable - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		SSC	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		SSC	Near-Threatened - Moyle 2013
Mylopharodon conocephalus	Hardhead		SSC	Near-Threatened - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus tshawytscha - CV fall	Central Valley fall Chinook salmon	SSC	SSC	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV late fall	Central Valley late fall Chinook salmon	SSC		Endangered - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
Herps				
Actinemys marmorata marmorata	Western Pond Turtle		SSC	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus boreas halophilus	California Toad			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	SSC	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	SSC	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	SSC	ARSSC
Taricha torosa	Coast Range Newt		SSC	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis fitchi	Valley Gartersnake			Not on any status lists
Thamnophis sirtalis sirtalis	Common Gartersnake			
Insects and Other Invertebrates				
Acentrella insignificans	A Mayfly			

Acentrella spp.	Acentrella spp.			
Anax junius	Common Green Darner			
Argia agrioides	California Dancer			
Argia emma	Emma's Dancer			
Argia nahuana	Aztec Dancer			
Argia spp.	Argia spp.			
Baetidae fam.	Baetidae fam.			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Brillia spp.	Brillia spp.			
Chironomidae fam.	Chironomidae fam.			
Cordulegaster dorsalis	Pacific Spiketail			
Cricotopus spp.	Cricotopus spp.			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Enallagma cyathigerum				Not on any status lists
Epeorus spp.	Epeorus spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Erpetogomphus compositus	White-belted Ringtail			
Erythemis collocata	Western Pondhawk			
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon spp.	Fallceon spp.			
Glossosoma spp.	Glossosoma spp.			
Glossosomatidae fam.	Glossosomatidae fam.			
Heptageniidae fam.	Heptageniidae fam.			
Hetaerina americana	American Rubyspot			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Ischnura perparva	Western Forktail			
Lepidostoma baxea	A Caddisfly			
Lepidostoma spp.	Lepidostoma spp.			
Lestes congener	Spotted Spreadwing			

Libellula croceipennis	Neon Skimmer			
Libellula saturata	Flame Skimmer			
Limnophyes spp.	Limnophyes spp.			
Ochrotrichia burdicki	A Caddisfly			
Pachydiplax longipennis	Blue Dasher			
Pantala flavescens	Wandering Glider			
Pantala hymenaea	Spot-winged Glider			
Plathemis lydia	Common Whitetail			
Polypedilum spp.	Polypedilum spp.			
Protoptila spp.	Protoptila spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Serratella micheneri	A Mayfly			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Stylurus olivaceus	Olive Clubtail			
Telebasis salva	Desert Firetail			
Tramea lacerata	Black Saddlebags			
Tricorythodes spp.	Tricorythodes spp.			
Zoniagrion exclamationis	Exclamation Damsel			
Mammals				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
Mollusks				
Anodonta californiensis	California Floater		SSC	
Ferrissia spp.	Ferrissia spp.			
Gyraulus spp.	Gyraulus spp.			
Margaritifera falcata	Western Pearlshell		SSC	
Menetus spp.	Menetus spp.			
Physa spp.	Physa spp.			
Physella virgata	Protean Physa			CS
Pisidium spp.	Pisidium spp.			
Planorbella tenuis	Mexican Rams-horn			CS
Planorbella trivolvis	Marsh Rams-horn			CS

Pyrgulopsis stearnsiana	Yaqui Springsnail			T
Sphaeriidae fam.	Sphaeriidae fam.			
Plants				
Alnus rhombifolia	White Alder			
Alopecurus carolinianus	Tufted Foxtail			
Alopecurus saccatus	Pacific Foxtail			
Anemopsis californica	Yerba Mansa			
Bolboschoenus maritimus ssp. paludosus	Saltmarsh Bulrush			Not on any status lists
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Carex pellita	Woolly Sedge			
Castilleja campestris ssp. succulenta	Fleshy Owl's-clover	Threatened	Endangered	CRPR - 1B.2
Cephalanthus occidentalis	Common Buttonbush			
Chloropyron palmatum	NA	Endangered	SSC	CRPR - 1B.1
Cyperus acuminatus	Short-point Flatsedge			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus squarrosus	Awned Cyperus			
Downingia bella	Hoover's Downingia			
Downingia cuspidata	Toothed Calicoflower			
Eleocharis acicularis ssp. acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Elodea canadensis	Broad Waterweed			
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle		SSC	CRPR - 1B.2
Eryngium vaseyi ssp. vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euphorbia hooveri	NA			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Hydrocotyle umbellata	Many-flower Marsh-pennywort			
Hydrocotyle verticillata ssp. verticillata	Whorled Marsh-pennywort			

Hypericum anagalloides	Tinker's-penny			
Juncus acuminatus	Sharp-fruit Rush			
Juncus xiphioides	Iris-leaf Rush			
Lasthenia ferrisiae	Ferris' Goldfields		SSC	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lilium pardalinum ssp. pardalinum	Leopard Lily			
Ludwigia palustris	Marsh Seedbox			
Ludwigia peploides ssp. peploides	Floating Water Primrose			Not on any status lists
Marsilea vestita ssp. vestita	Hairy Pepperwort			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Mimulus latidens	Broad-tooth Monkeyflower			
Mimulus pilosus	Snouted Monkey Flower			
Mimulus tricolor	Tricolor Monkeyflower			
Myosurus minimus	Little Mouse Tail			
Navarretia leucocephala ssp. leucocephala	White-flower Navarretia			
Orcuttia inaequalis	San Joaquin Valley Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Orcuttia pilosa	Hairy Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Persicaria lapathifolia	Common Knotweed			Not on any status lists
Persicaria punctata	Dotted Smartweed			Not on any status lists
Phalaris arundinacea	Reed Canarygrass			
Pilularia americana	Pillwort			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys distantiflorus	California Popcorn-flower			
Plagiobothrys undulatus	Coast Allocarya			Not on any status lists
Platanus racemosa	California Sycamore			
Pogogyne douglasii	Douglas' Pogogyne			
Potamogeton diversifolius	Water-thread Pondweed			
Potamogeton nodosus	Longleaf Pondweed			
Potamogeton pusillus pusillus	Slender Pondweed			

Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Puccinellia simplex	Little Alkali Grass			
Rorippa palustris ssp. palustris	Bog Yellowcress			
Sagittaria sanfordii	Sanford's Arrowhead		SSC	CRPR - 1B.2
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Schoenoplectus acutus ssp. occidentalis	Hardstem Bulrush			
Sequoia sempervirens	Coast Redwood			
Sidalcea calycosa ssp. calycosa	Annual Checker-mallow			
Tuctoria greenei	Green's Awnless Orcutt Grass	Endangered	Rare	CRPR - 1B.1
Wolffia columbiana	Columbian Watermeal			
Wolffia globosa	Asian Watermeal			

Notes:
ARSSC = At-Risk Species of Special Concern
BCC = Bird of Conservation Concern
BSSC = Bird Species of Special Concern
CRPR = California Rare Plant Rank
CS = Currently Stable
IUCN = International Union for Conservation of Nature
SSC = Species of Special Concern

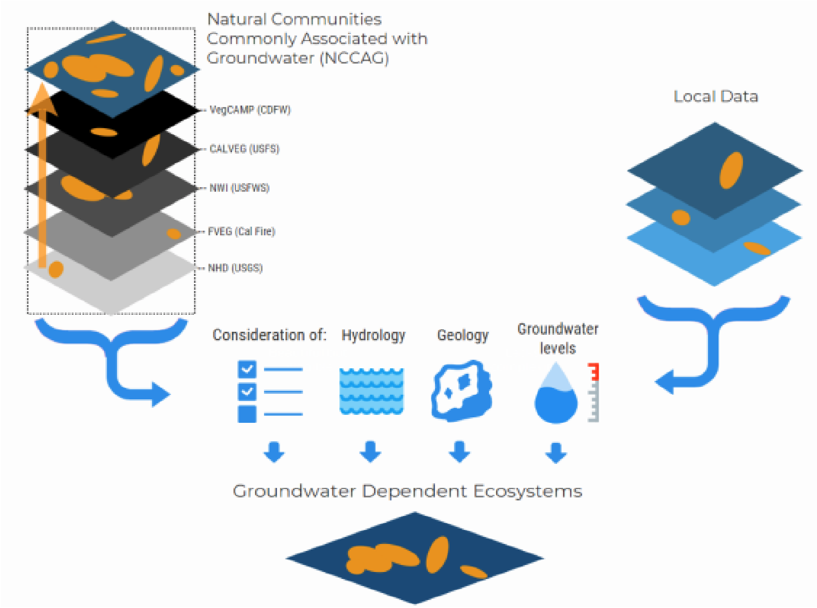
Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[6] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[7]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[6] *NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/*

[7] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[8]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[9] on the Groundwater Resource Hub[10], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[8] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[9] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[10] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

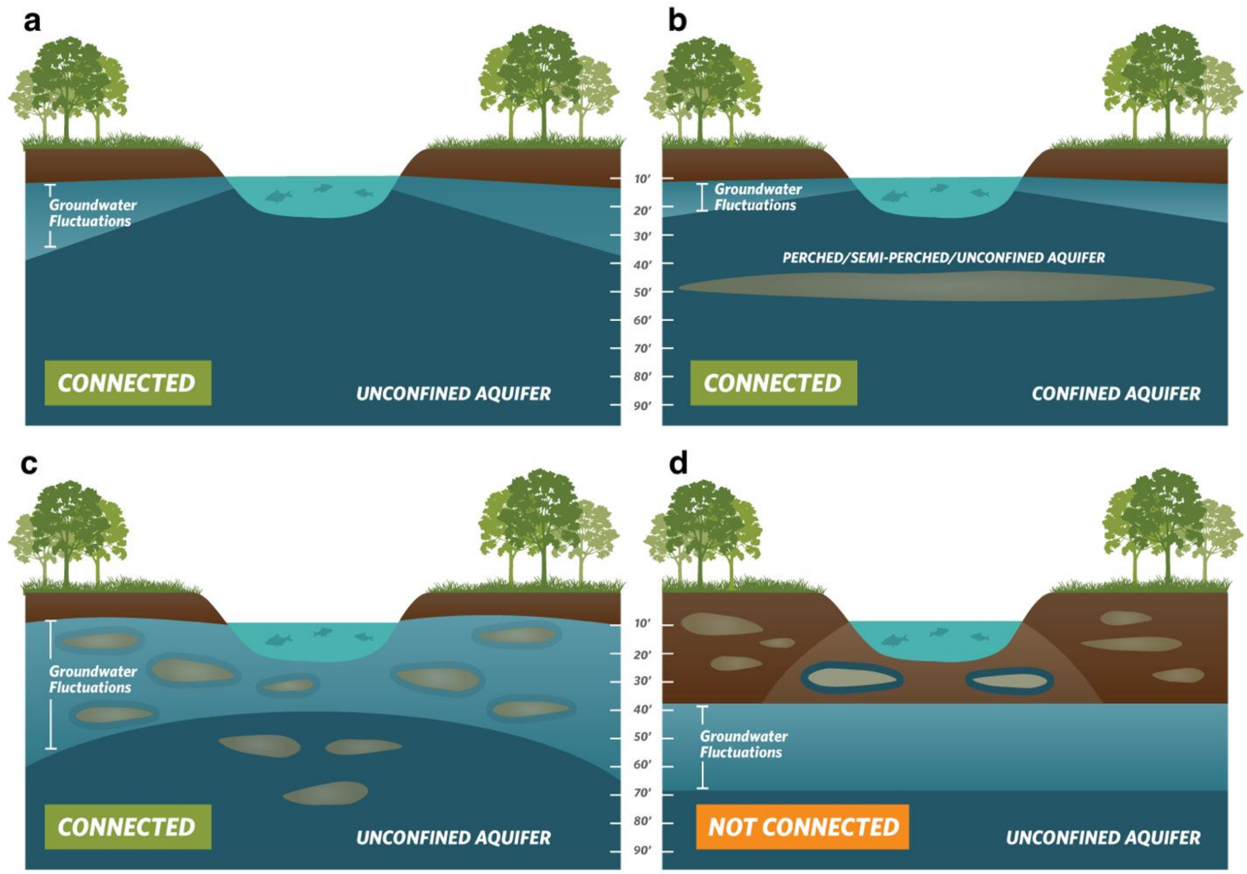

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[11] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[12] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[13] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[14]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

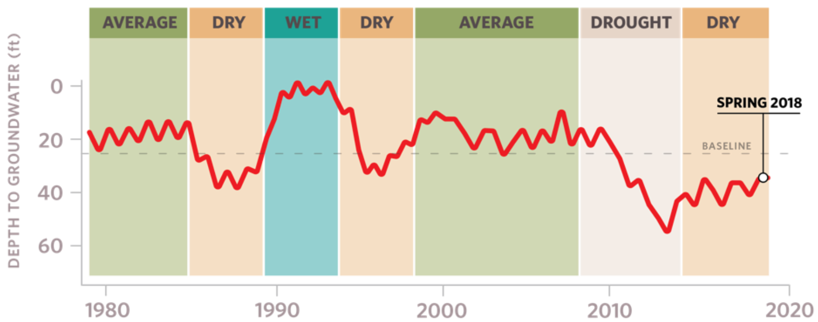

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[11] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[12] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[13] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[14] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[15], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

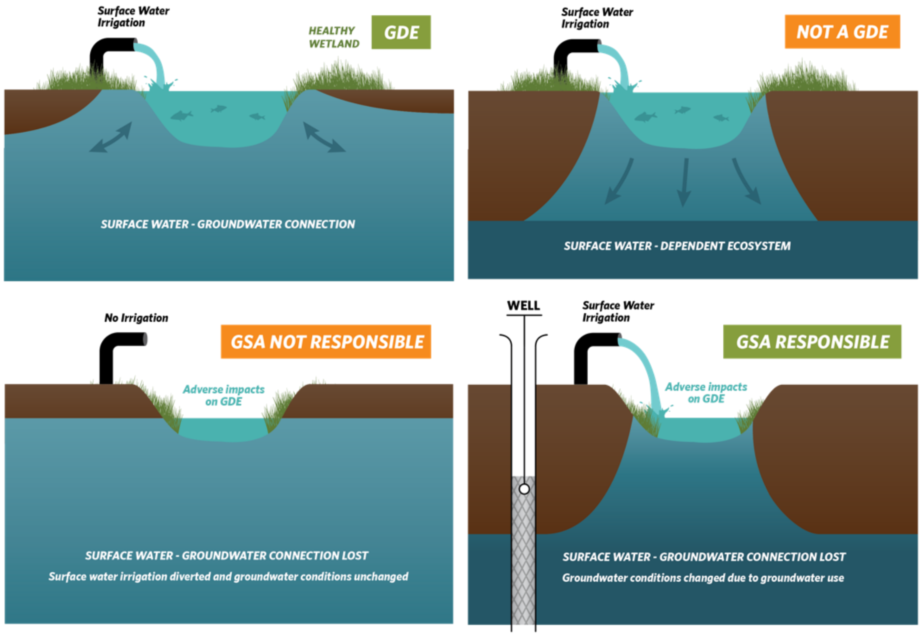

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[15] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

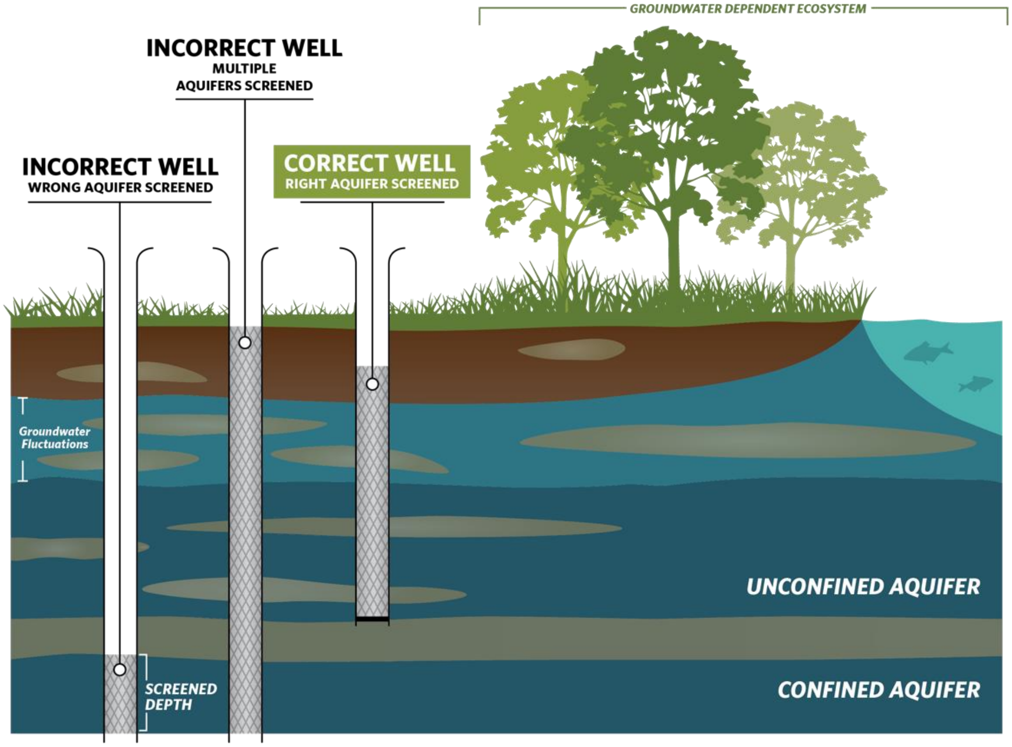


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[16] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

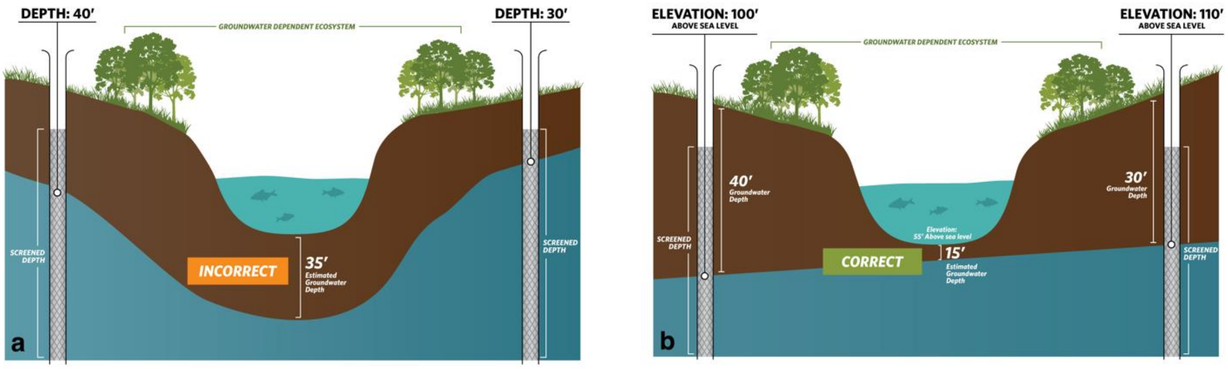


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

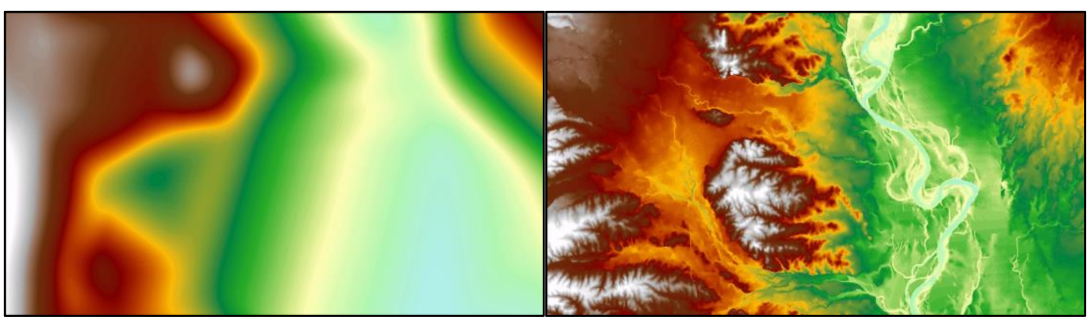


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[16] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

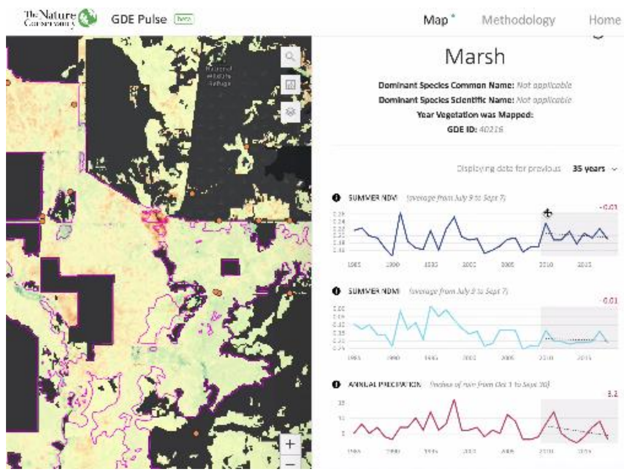
Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

The Nature Conservancy
Protecting nature. Preserving life.

Visit https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[17]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[18]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[17] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[18] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F

The GSA's Response to TNC Comments on the Draft GSP are located on DWR's SGMA portal as Part 2 of 2.

Attachment G

Mapping Likely Interconnected Surface Water
The Nature Conservancy, California, May 2020

Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, ISW is defined as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:
The groundwater elevation data, available for Spring 2011-2012, and Spring and Fall 2013-2018, comes from the California Department of Water Resources (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). These data are represented as continuous raster layers that approximates "feet above or below mean sea level" based on groundwater well measurements. According to the documentation online, groundwater level measurements were selected based on measurement date and well construction information (where available) and are intended to approximate the groundwater levels in the unconfined to uppermost semi-confined aquifers. Each of the raster layer has a different extent, but all of them are limited to the Central Valley. To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

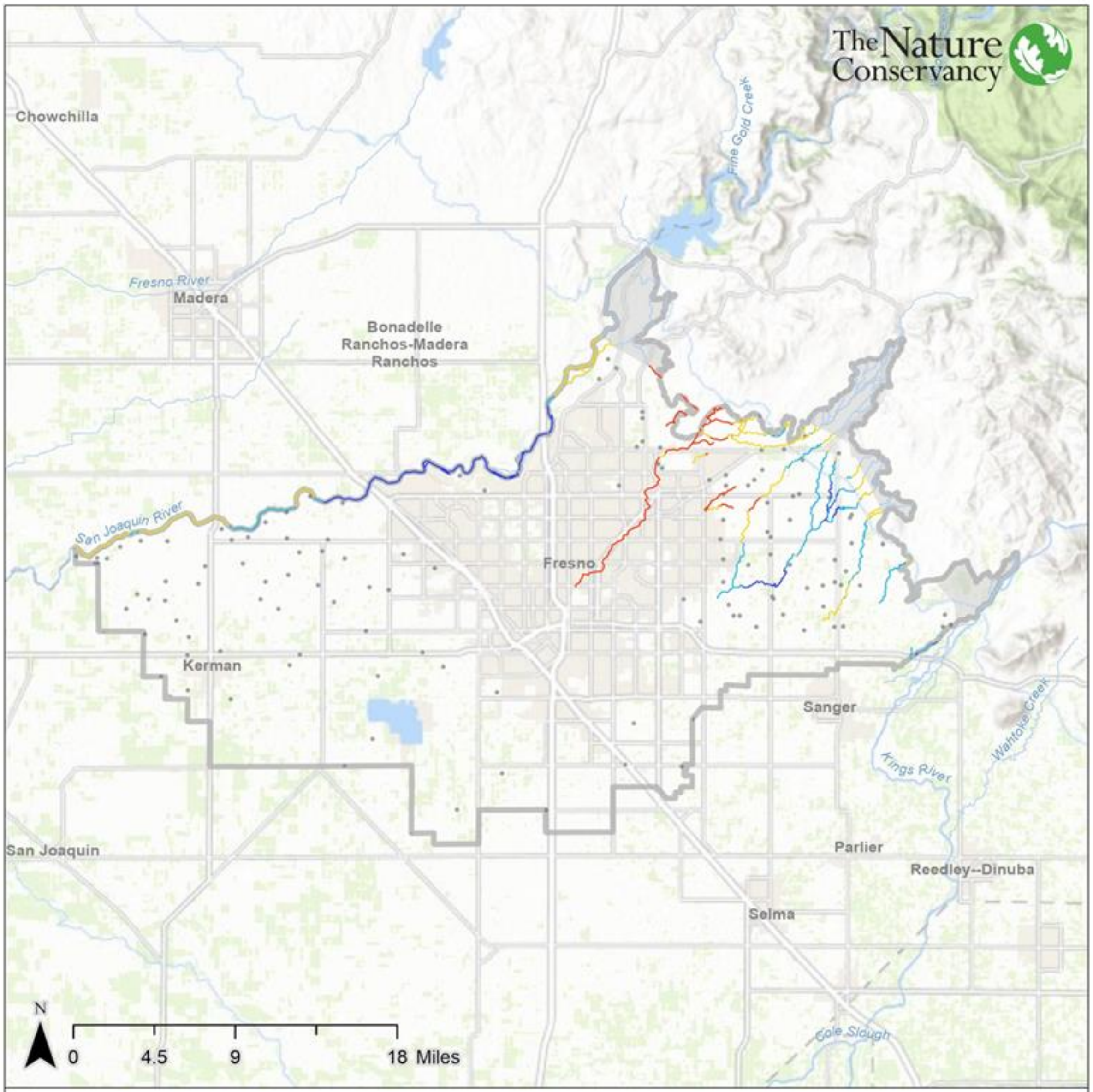
The map splits groundwater depth into four categories:

- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.
- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.

Interconnected Surface Water: Minimum Groundwater Depth (2011-2018)

North Kings GSA GSP



Legend

- Groundwater Sustainability Agency (GSA)
- No groundwater depth data available
- Rivers and streams with no depth data (61.9 miles)
- Groundwater Elevation Monitoring Point

Minimum Groundwater Depth

- Connected - Gaining: Groundwater at or above stream surface (22.8 miles)
- Connected - Losing: Groundwater within 20 feet of stream surface (31.9 miles)
- Uncertain*: Groundwater within 20-50 feet of stream surface (44.5 miles)
- Likely Disconnected*: Groundwater greater than 50 feet below stream surface (23.7 miles)

**Streams could be connected to riparian or perched aquifers or shallow aquifers that are poorly characterized. More data are needed to confirm disconnected status.*

5-022.08_Kings_NorthKings

Data Sources:
CA Dept. of Water Resources Groundwater Elevation Data, gis.water.ca.gov/app/gicima/
NHD Plus V2 Streams, nhdplus.com/NHDPlus/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[19]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[20]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[21] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[19] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[20] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[21] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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GroundwaterResourceHub.org

May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Northern & Central Delta-Mendota Regions Groundwater Sustainability Plan (GSP), Delta Mendota Subbasin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Northern and Central Delta-Mendota Regions Groundwater Sustainability Plan (GSP) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing *sustainable* groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be insufficient in addressing environmental beneficial uses and users.

The identification of environmental beneficial users, as well as their consideration when establishing the sustainability goal, undesirable results, minimum thresholds and measurable objectives were insufficient (23 CCR §355.4(b)(4)) and lacked best available science (23 CCR §355.4(b)(1)). In the face of existing, severe overdraft, the GSP would allow groundwater management to largely ignore potential impacts to environmental beneficial users. This could result in irreparable harm to these beneficial users, undermining the intent of SGMA to achieve sustainability.

Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address within 180 days. In these cases, we strongly recommend that the Department, at a minimum, set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update. SGMA's success is contingent upon avoiding undesirable results. Should the treatment of environmental beneficial users be indicative of the quality of the overall plan, then we recommend the Department deem the plan inadequate.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides a map and method summary of possible ISWs.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We appreciate that the GSP incorporated a portion of our feedback, however we disagree with the components where our feedback was ignored. This suggests a limited degree of engagement of environmental beneficial users and could result in a definition of sustainability that is biased towards a limited set of users in the basin. In our experience, the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan" (Emergency Regulations Section 355.4(b)(10).

TNC recommendation: We recommend that DWR require the GSA to prioritize stakeholder engagement through improvements to their stakeholder engagement plan, partnerships, more representative governance and funding decisions. In the spirit of continual improvement embedded in SGMA, we would like to offer the following input as areas for improvement in the next version of the GSP.

Interconnected Surface Waters (ISWs) – The GSP took steps towards identifying ISWs, however improvements should be made to identify gaining and losing reaches and/or to account for the spatial and temporal variations in stream depletions that are inherent with California's Mediterranean climate. These components are necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)).

The GSP analysis of ISW in their region (including a list of 10 sources used to identify the San Joaquin River as ISW) is largely consistent with our analysis of groundwater levels from 2011-2018 (see Attachment F). Our analysis also indicates that the streams stemming from the west side of the sub-basin are likely disconnected. However, these streams may be interconnected with riparian or perched aquifers, so additional monitoring should be required to confirm disconnection. Also, any area where a lack of shallow groundwater data makes the determination of ISWs uncertain should be identified as a data gap rather than being assumed to be disconnected. The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted." "At any point" has both a spatial and temporal component. Even short durations of interconnection between groundwater and surface water can be crucial for surface water flow and support of GDEs.

Map and Assessment of potential ISWs:

By combining multiple years and seasons of groundwater depth data, The Nature Conservancy has determined that within the Northern and Central Delta-Mendota Region GSP, 58.9 river miles are gaining, 9.5 are losing, and the rest are uncertain or likely disconnected (based on streams with available groundwater depth data). Attachment F contains a one-page method summary and a GSP-specific map of ISWs. The interconnected surface water displayed on the map is based on the minimum groundwater depth estimated by the California Department of Water Resources between 2011 and 2018.

Note: In most cases, the groundwater depth data used to generate the ISW map does not include perched aquifers. As such, some streams marked as disconnected could in actuality, be connected.

<u>TNC recommendation:</u> TNC recommends obtaining additional shallow groundwater level data (and possibly installing additional shallow wells) and the installation of stream gages to obtain additional surface flow information to inform a thorough review of surface water-groundwater interconnectivity including estimation of the quantity and timing of streamflow depletions in the Subbasin. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 4,852 acres of potential GDEs occur in the GSA boundary. TNC developed the Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

TNC applauds the documentation of potential wetland and vegetative GDEs from TNC's and DWR's NC Dataset Viewer and the list of freshwater species for the Delta-Mendota Subbasin in the GSP. GDEs are plant and animal communities that require groundwater to meet some or all of their water needs. Establishing where GDEs exist on the landscape requires the use of spatial and temporal data including groundwater levels. The use of an arbitrary 100-foot boundary and reliance on the "professional judgement and local knowledge" to exclude potential GDEs is based on a generalized resource protection zone used by Caltrans to protect surface features and habitats from construction-related impacts, and is a common avoidance buffer related to permit requirements, Storm Water Pollution Prevention Plans (SWPPP), and/or CEQA/NEPA avoidance and minimization measures.

<u>TNC Recommendation</u>: TNC recommends that the GSA utilize groundwater level information to support the establishment of GDEs and elaborate on the correlation of groundwater level and plant physiological data to exclude potential GDEs. Although we appreciate the inclusion of this information; the information was not analyzed, elaborated on, no data gaps were identified, and no monitoring plan was put in place to specifically improve the understanding of GDEs.

Water Budget – We were disappointed to see that the water budget did not include the current, historical and projected demands of native vegetation and/or managed wetlands, as required under SGMA (Emergency Regulations Section 354.18(a) and (b)(3)). The GSP only focused on a subset of water use sectors, such as urban and agricultural users of groundwater. This is problematic because key environmental uses of groundwater are not being accounted for as

[1] Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

water supply decisions are made using this budget nor will they likely be considered in project and management actions.

TNC recommendation: As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). The GSP defined significant and undesirable results as a reduction in habitat productivity for the chronic lower of groundwater levels and reduction in groundwater storage SMCs. However, the minimum thresholds do not describe how a decline in groundwater level will affect GDEs and ISWs.

TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

Monitoring Network – We were disappointed to see that the GSP did not include a monitoring for that adequately characterizes the interaction of GDEs and other environmental beneficial users of surface water and groundwater, as required by 23 CCR §354.34. The GSP does not adequately characterize the interaction of GDEs and other environmental beneficial users of surface water and groundwater. GDEs are potentially located along surface water bodies where no shallow groundwater monitoring is proposed, leaving recognized data gaps unfilled. Therefore, GDEs and ISWs are not being specifically addressed by the monitoring network in the GSP.

TNC recommendation: The monitoring network should include: (1) additional monitoring to verify possible GDEs and reaches that include ISWs, (2) expanding the discussion of how monitoring data will be used to verify GDEs and ISWs, and (3) adding ecological monitoring to assess potential impacts to GDEs or ISWs.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but *sustainable* groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto

Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Northern & Central Delta-Mendota Regions Groundwater Sustainability Plan

The Northern and Central Delta-Mendota Regions Groundwater Sustainability Plan (GSP), adopted November 2019 as Resolution 2019-0733, was reviewed by TNC. TNC submitted comments on the Public Draft GSP on October 10, 2019. However, responses to comments on the public draft were not publicly available so we compared the Public Draft GSP to the Final GSP to determine if changes were made to the Final GSP text that addressed TNC's previously submitted comments. This attachment lists our original comments on the complete Public Draft GSP, as submitted to the GSA during the public comment period, and states whether or not they were addressed in the Final GSP *[as green text in brackets]*. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

[Section 4.1 Description of Beneficial Uses and Users in Plan Area (pp. 4-1 to 4-3)]

- *[Our comment was not addressed. No changes to GSP text made.]* The California Water Code §1305(f) defines that beneficial uses of waters of the State include "preservation and enhancement of fish, wildlife, and other aquatic resources and preserves" (p. 4-1). Table 4-1 lists beneficial uses and user stakeholder groups (pp. 4-2 to 4-3) and includes federal and state lands and facilities; environmental agencies and groups; rivers, creeks, and recreational and wildlife refuges; and recreational areas in addition to the direct users of groundwater and surface water. The GSP noted further refinement of the Table 4-1 list will be made by 2025. Please describe whether other beneficial uses and users of groundwater in the Subbasin are present: Protected Lands, including conservation areas and other protected lands; and Public Trust Uses including wildlife, aquatic habitat, fisheries, and recreation.
- *[Our comment was not addressed. No changes to GSP text made.]* The types and locations of environmental uses, species and habitats supported, and the designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the Subbasin should be specified. Please identify environmental users, and refer to the following:
    - Natural Communities Commonly Associated with Groundwater dataset (NC Dataset) - https://gis.water.ca.gov/app/NCDatasetViewer/
    - The list of freshwater species located in the Delta-Mendota Subbasin in Attachment C of this letter. Please take particular note of the species with protected status.

Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8)

[Section 2.2.1 General Plans in Plan Area (p. 2-42 to 2-66)]

- *[Our comment was not addressed. No changes to GSP text made.]* Figure 2-26 (p. 2-43) shows the area covered by city, community, and county general plans. There are five county plans, one city plan, and three community plans that cover a portion of the Northern and Central Delta-Mendota Regions. The plans should be modified to include a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals. Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs.
- *[Our comment was not addressed. No changes to GSP text made.]* In general, the plans seek to protect riparian habitat. This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin and if they are associated with critical, GDE or ISW habitats. Please identify all relevant HCPs and NCCPs within the Subbasin and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.
- *[Our comment was not addressed. No changes to GSP text made.]* Please refer to the Critical Species Lookbook[2] to review and discuss the potential groundwater reliance of critical species in the basin. Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.

[Section 2.1.2.2 Major Water-Related Infrastructure (p. 2-10 to 2-12)]

- *[Our comment was not addressed. No changes to GSP text made.]* The GSP provides a description of the major water infrastructure projects including the Central Valley Project, the State Water Project, and the Tracy Fish Collection Project, however there is no discussion of any in-stream flow requirements. Please describe any current or planned in-stream flow requirements of the San Joaquin and Merced Rivers or any of the westside creeks.

[Section 2.3.2 County Well Construction/Destruction Standards and Permitting (p. 2-77)]

- *[Our comment was not addressed. No changes to GSP text made.]* Table 2-7 (p. 2-78) summarizes well permitting requirements and county ordinances for the counties of Fresno, San Benito, Merced, Stanislaus, and San Joaquin. The counties have ordinances that limit groundwater export and several counties have ordinances that minimize unsustainable groundwater extraction. Please include a discussion of the following in this section:
  - Future well permitting must be coordinated with the GSP to assure achievement of the Plan's sustainability goals.

[2] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

- The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF v. SWRCB and Siskiyou County, No. C083239). The need for well permitting programs to comply with this requirement should be stated in the text.

Checklist Items 5, 6, and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 5.2.5.2 Definable Bottom of Basin (p. 5-12)]

- *[Our comment was not addressed. No changes to GSP text made.]* Defining the bottom of Subbasin based on geochemical properties is a suitable approach for defining the base of freshwater, however, as noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom. This will prevent the possibility of extractors with wells deeper than the basin boundary (defined by the base of freshwater) from claiming exemption of SGMA due to their well residing outside the vertical extent of the basin boundary.

[Section 5.2.6.1 Principal Aquifers (p. 5-12 to 5-14)]

- *[Our comment was not addressed. No changes to GSP text made.]* The very shallow unconfined groundwater falls under DWR's definition of a principal aquifer, which is defined as "aquifer or aquifer system that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems" [*23 CCR §351(aa)*]. Thus, disregarding this shallow groundwater as a principal aquifer due to its "shallow nature and high salinity" is inadequate. This is especially true in the places where projects to develop the shallow groundwater may be considered for use on more salt-tolerant crops. SGMA requires GSAs to sustainably manage groundwater resources in all aquifers, especially if groundwater use and management can result to impacts on beneficial uses and users. Please refer to Best Practice #1 in Attachment C for further explanation and accompanying graphics.

[Section 5.2.6.2 Aquifer Properties p. 5-14 to 5-31]

- *[Our comment was not addressed. No changes to GSP text made.]* Regional basin-wide geologic cross sections are provided in Figures 5-7 through 5-16 (p. 5-15 to 5-27). These cross-sections do not include a graphical representation of the manner in which the very shallow groundwater or perched water may interact with ISWs or GDEs that would allow the reader to understand this topic. Please include example near-surface cross section details that depict the conceptual understanding of shallow groundwater and stream interactions at different locations, including the perched aquifer and the Upper Aquifer.

- *[Our comment was not addressed. No changes to GSP text made.]* The two-aquifer system is separated primarily by the Corcoran Clay, which has a variable depth as shown on Figure 5-17 (p. 5-28). The Corcoran Clay is absent in the far western parts of the Subbasin. There is also a Very Shallow unconfined groundwater zone, and perched water is sometimes present due to fine-grained clay layers. Please provide a map showing where the Very Shallow groundwater zone and the perched aquifers are located.

[Section 5.3.2.4 Groundwater Trends (p. 5-92 to 5-118)]

- *[Our comment was not addressed. No changes to GSP text made.]* Data gap areas for the Upper Aquifer, Lower Aquifer, or both are shown in Figure 5-64 (p. 5-96). Much of the data gaps area is located within the Northern and Central Delta-Mendota Regions. There are very few wells screened in the Upper Aquifer shown in the groundwater contour map in Spring 2013 and Fall 2013, as shown on Figures 5-80 and 5-81, within the Northern and Central Delta-Mendota Regions. Please explain how these data gaps will be filled or refer to a section later in the GSP.
- *[Our comment was not addressed. No changes to GSP text made.]* Well hydrographs are shown for wells screened in the Very Shallow Groundwater in Figure 5-67 (p. 5-99). Please indicate which of these wells are located within the Northern and Central Delta-Mendota Regions.
- *[Our comment was not addressed. No changes to GSP text made.]* The GSP states (p. 5-94) that vertical gradients are restricted by the Corcoran Clay. In the western part of the Subbasin, interfingering clay layers minimize downward gradients, except where the clay has been compromised by the construction of composite wells. Please provide data or analysis to explain and substantiate the vertical gradients noted in the text.

<u>Checklist Items 8, 9, and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)</u>

[Section 5.3.7 Interconnected Surface Water Systems (p. 5-170 to 5-172)]

- *[Our comment was not addressed. No changes to GSP text made.]* The regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. ISWs can be either gaining or losing. The text states (p. 5-170) "Streams stemming from the west side of the Delta-Mendota Subbasin are ephemeral in nature, and only two of these creeks reach the San Joaquin River (Del Puerto Creek and Orestimba Creek). These creeks lose their flows to the underlying vadose zone (net-losing streams) and therefore do not represent areas of potential GDEs." No evidence is provided in the Plan that states that these streams are not connected to the upper-most aquifer along some portion of the drainage for some time period. TNC disagrees with the statement that these westside ephemeral streams do not represent areas of potential GDEs, without data or analysis provided. Please reconcile data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP to improve ISW mapping in future GSPs.

- *[Our comment was not addressed. No changes to GSP text made.]* Please provide more detail on how the quantity of gains and/or depletions from the groundwater at each reach of the San Joaquin River was determined. For example, were the values taken from the cited literature sources or determined from further analysis or modeling? Please provide or refer to a map that shows the designated reaches listed in Table 5-9.

Checklist Items 11 to 15, Identifying and Mapping GDEs (23 CCR §354.16)

[Section 5.3.7.6 Groundwater Dependent Ecosystems (p. 5-172)]

- *[Our comment was not addressed. No changes to GSP text made.]* The text states (p. 5-172): "To further screen available information regarding GDEs, the following standards were set for identifying GDEs in the Northern and Central Delta-Mendota Regions: (1) areas with depths to groundwater levels greater than 30 feet were eliminated unless the vegetation identified in those areas were consistent with species with deep root systems (e.g. live oaks); (2) seasonally-managed areas and wetlands were eliminated due to their dependence on applied surface water; and (3) a 100-foot buffer was applied around the San Joaquin River within the Northern Delta-Mendota Region to include all communities in the NCCAG dataset as potential GDEs, except where professional judgement and local knowledge determined GDEs were not present." The three standards are discussed in turn below.
- *[Our comment was not addressed. No changes to GSP text made.]* The following comments apply to *Standard (1): Areas with depth to groundwater greater than 30 feet in Spring 2015, unless the vegetation identified in those areas were consistent with species with deep root systems (e.g. live oaks).*
    - *[Our comment was not addressed. No changes to GSP text made.]* While depth to groundwater levels within 30 feet are generally accepted as being a proxy for confirming that polygons in the NC dataset are connected to groundwater, it is highly advised that seasonal and interannual groundwater fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one point in time (e.g., Spring 2015) can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Based on a study we recently submitted to Frontiers in Environmental Science Journal, we've observed riparian forests along the Cosumnes River to experience a range in groundwater levels between 1.5 and 75 feet over seasonal and interannual timescales. Seasonal fluctuations in the regional water table can support perched groundwater near an intermittent river that seasonally runs dry due to large seasonal fluctuations in the regional water table. While perched groundwater itself cannot directly be managed due to its position in the vadose zone, the water table position within the regional aquifer (via pumping rate restrictions,

restricted pumping at certain depths, restricted pumping around GDEs, well density rules) and its interactions with surface water (e.g., timing and duration) can be managed to prevent adverse impacts to ecosystems due to changes in groundwater quality and quantity under SGMA. We highly recommend using depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. Please refer to Attachment C of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network. Additionally, Spring 2015 is after the SGMA benchmark date of January 1, 2015. Please include groundwater condition data prior to the SGMA benchmark date in the analysis.

- *[Our comment was not addressed. No changes to GSP text made.]* Please confirm that wells screened in the Upper Aquifer are being used to verify whether NCCAGs are actual GDEs, given the significant data gap areas noted on Figure 5-64 (page 5-96). Using "depth to groundwater" measurements from confined aquifers is mapping piezometric head of the confined aquifer and not detecting groundwater conditions in the principal aquifers of the unconfined aquifer that are supporting the ecosystem. If there is insufficient groundwater level data in the Upper Aquifer, then the NCCAGs in these areas should be included as GDEs in the GSP until data gaps are reconciled in the monitoring network.
- *[Our comment was not addressed. No changes to GSP text made.]* Please provide depth to groundwater contour maps and note the following best practices for doing so.
  - i) Are the wells used for interpolating depth to groundwater sufficiently close (<5km) to NC Dataset polygons to reflect local conditions relevant to ecosystems?
  - ii) Are the wells used for interpolating depth to groundwater screened within the surficial unconfined aquifer and capable of measuring the true water table (see comment b above)?
  - iii) Is depth to groundwater contoured using groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape? This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make. It is better to assume that water surface elevations are constant in between wells, and then calculate

depth to groundwater using a DEM of the land surface to contour depth to groundwater.

  - *[Our comment was not addressed. No changes to GSP text made.]* Please use care when considering rooting depths of vegetation. Please list the species in each GDE, and whether the GDE was eliminated or retained based on the 30-foot standard and provide evidence for the decision. While Valley Oak (*Quercus lobata*) have been observed to have a max rooting depth of ~24 feet (https://groundwaterresourcehub.org/gde-tools/gde-rooting-depths-database-for-gdes/), rooting depths are likely to spatially vary based on the local hydrologic conditions available to the plant. Also, max rooting depths do not take capillary action into consideration, which will vary with soil type and is an important consideration since woody phreatophytes generally do not prefer to have their roots submerged in groundwater for extended periods of time, and hence can access groundwater at deeper depths.

- *[Our comment was not addressed. No changes to GSP text made.]* The following comment applies to *Standard (2): Habitat areas with supplemental water*. The application of supplemental water to managed wetlands <u>does not preclude</u> the possibility that NC polygons could be accessing groundwater in addition to the supplied water. In the scientific literature, it is generally acknowledged that GDEs can rely on groundwater for <u>some or all</u> of their requirements. GDEs can rely on multiple water sources simultaneously and at different temporal/spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow). SGMA defines GDEs as "ecological communities and species that depend on groundwater <u>emerging from aquifers</u> or on groundwater <u>occurring near</u> the ground surface". Hence, we recommend that depth to groundwater contour maps are used to identify whether a connection to groundwater exists for the managed wetlands in the Northern and Central Delta-Mendota Regions. Please refer to Attachment C of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.
- *[Our comment was not addressed. No changes to GSP text made*. Caltrans standards under the Coastal Act were cited to support Standard (3), but these standards apply to a generalized resource protection zone related to construction activities and avoidance of construction impacts to surface features and habitat, not groundwater dependent ecosystems.] The following comment applies to *Standard (3): 100-foot buffer area applied around the San Joaquin River.* We disagree with the use of an arbitrary 100-foot cutoff and reliance on the "professional judgement and local knowledge". Instead, please explain how this criterion is supported by groundwater level and plant physiological data to exclude potential GDEs near the river.
- *[Our comment was not addressed. No changes to GSP text made.]* On p. 5-176 the GSP states, "Possible GDEs have also been identified along streams originating from the Coast Range; however, these areas are topographically disconnected from the Subbasin's principal aquifers and are located in areas of de minimus or zero groundwater use and are therefore are unmanageable through the Sustainable Groundwater Management Act (SGMA)." Please provide further information on the

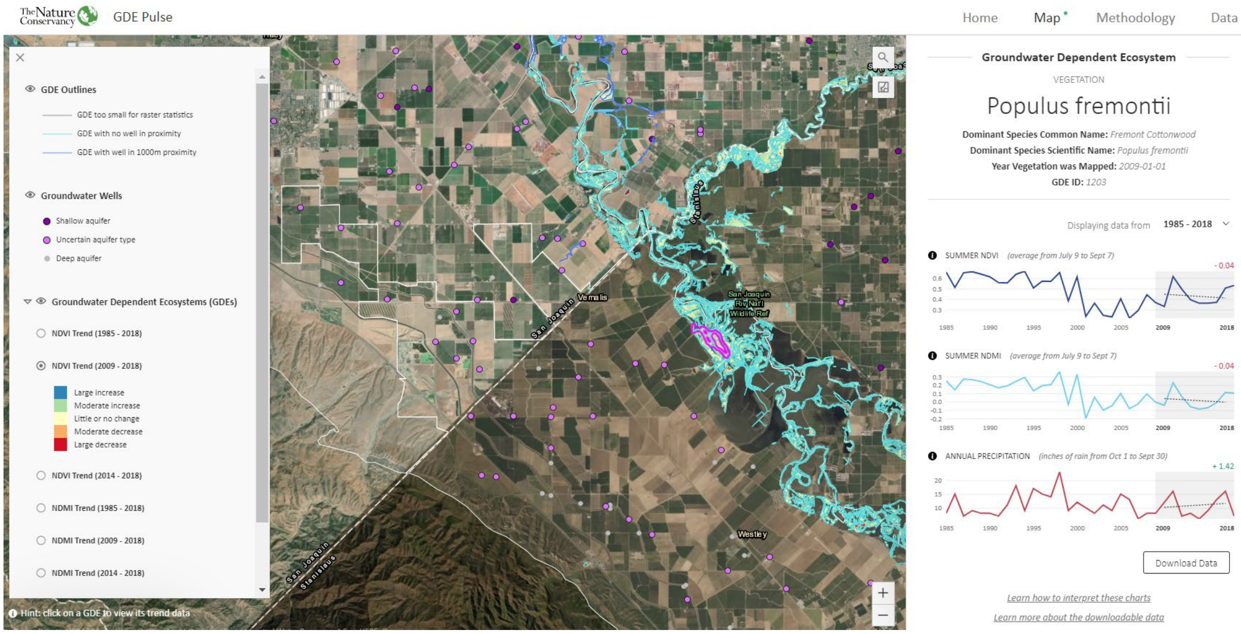
analysis of GDEs on westside streams, including citing field studies or modeling studies that show the disconnected nature of these streams. Indicate on which streams GDE polygons were excluded and on which streams GDE polygons were retained. Identify any data gaps and ensure that GDE polygons are retained until data gaps are reconciled.

- [Our comment has been adequately addressed through GSP text changes. Figures 5-118 and 5-119 were modified to enhance visualization of categories by modifying the map symbology to clearly demarcate the GSP region and potential GDEs.] On Figures 5-118 and 5-119, it's difficult to distinguish the colors underneath the hatching, and thus see which categories apply to the Northern and Central Delta-Mendota Regions. Consider changing the hatching pattern or supplying a map for just the Northern and Central Delta-Mendota Regions. Please be more specific when denoting "mapping error" (p. 5-176). The basin's GDE shapefile, which is submitted via the SGMA Portal, should also include two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).

Checklist Items 16 to 20, Describing GDEs (23 CCR §354.16)

[Section 5.3.7.6 Groundwater Dependent Ecosystems (p. 5-172)]

- *[Our comment was not addressed. No changes to GSP text made.]* Please provide information on the historical or current groundwater conditions in the GDEs or the ecological conditions present. Refer to GDE Pulse (https://gde.codefornature.org; See Attachment D of this letter for more details) or any other locally available data (e.g., leaf area index, evapotranspiration or other data) to describe depth to groundwater trends in and around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in the Northern and Central Delta-Mendota Regions.



- *[Our comment was not addressed. No changes to GSP text made.]* Please provide an ecological inventory (see Appendix III, Worksheet 2 of the GDE Guidance) for all potential GDEs that includes the vegetation types or habitat types and rank the GDEs as having a high, moderate or low value; and what characterizes the rank.
- [Table 5-10 in the GSP includes the list of freshwater species located in the Delta-Mendota Subbasin that was included in Attachment C of TNC's December 10, 2019 comment letter to the draft GSP. We appreciate the inclusion of this information; however, the information was not analyzed, elaborated on, and no data gaps were identified.] Please identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat were found in or near any of the GDEs since some organisms rely on uplands and wetlands during different stages of their lifecycle. Resources for this include the list of freshwater that can be found in Table 5-10 of the GSP. Additional resources include the Critical Species Lookbook and CDFW's CNDDB database.

<u>Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)</u>

[Section 5.4 Water Budgets (p. 5-181 to 5-235)]

- *[Our comment was not addressed. No changes to GSP text made.]* Evapotranspiration is included as an outflow category in the land surface budget; however, it is not split between type of evapotranspiration. Please separate this term by land-use type (for example, agricultural; municipal and domestic; and native and riparian).
- *[Our comment was not addressed. No changes to GSP text made.]* Groundwater outflow to ET does not appear to be identified as a groundwater budget component. Since GDEs (including wetlands, riparian vegetation, phreatophytes and other

communities) are recognized as beneficial users of groundwater in the Northern and Central Delta-Mendota Regions, it is appropriate to include them in these calculations.

Checklist Item 23-26 Sustainability Goal (23 CCR §354.24)

[Section 6.2 Sustainability Goal (p. 6-2)]

- *[Our comment was not addressed. No changes to GSP text made.]* Since GDEs are present within the Subbasin (please see comments under checklist items 16-20) they should be recognized as beneficial users of groundwater and should be included in the Sustainability Goal. In addition, a statement about any intention to address pre-SGMA impacts to GDEs and ISWs should be included here and within the interim milestones and measurable objectives. Request that the connectivity of GDEs and ISWs to each aquifer be made clear. If we are talking about connectivity to the very shallow surficial aquifer we also need to establish if its current and, or future management to determine if it is a principal aquifer and therefore should be included in the sustainability goal and sustainability criteria. If it isn't a principal aquifer, please add statements that the future protection of GDEs would be incorporated into the 5-yr update as future management plans are developed.
- *[Our comment was not addressed. No changes to GSP text made.].*] The GSP states that there are time periods of ISW connectivity along the San Joaquin River on the northern end of the basin. Please include protection of ISWs as a part of the Sustainability Goal.
- *[Our comment was not addressed. No changes to GSP text made.]* GDEs are dependent, in part, on suitable water quality; however, this GSP only considers water quality for irrigation and domestic use. Since GDEs may also be affected by water quality they should be included in the Sustainability Goal.

Checklist Item 26 – Measurable Objectives (23 CCR §354.30)

[Section 6.3.1.3 Measurable Objectives for Groundwater Levels (p. 6-10)]

- *[Our comment was not addressed. No changes to GSP text made.]* This Measurable Objective does not consider GDEs. Please include GDEs (see comments under Checklist Items 16-20) in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.

[Section 6.5.3 Measurable Objectives for Water Quality (p. 4-29)]

- *[Our comment was not addressed. No changes to GSP text made.]* This Measurable Objective does not consider water quality needs of GDEs. Please modify this section to specifically address degraded water quality from total dissolved solids (TDS), arsenic (As), boron (B), and other potential constituents of concern to wildlife and vegetation communities of GDEs.

[Section 6.3.6.3 Measurable Objectives and Interim Milestones (for Interconnected Groundwater Surface Water Systems) (p. 6-35)]

- *[Our comment was not addressed. No changes to GSP text made.]* The GSP states that depletions will be considered from monitoring data collected in 2020 to 2025 and proposes a qualitative statement of no increased depletions. Based on statements made in Chapter 5, Sections 5.3.7 (pp. 5-170 to 5-173), this GSP only considers gaining and losing reaches of the San Joaquin River as being potentially interconnected (See Table 5-9 on p. 5-172). There are several ephemeral streams that may reach the San Joaquin in a given year that are dismissed because they are not regularly connected and, or flow is ephemeral. Streams that are not continuously connected spatially and, or temporally, or are ephemeral in nature, are still potential ISWs and should not be excluded from this GSP. Ephemeral water courses in the basin include Orestimba Creek, Del Puerto Creek, Mercy Creek, Hospital Creek, Inghram Creek Salado Creek, and Cow Creek. For example, on page 4-7 in the *Stanislaus County Hydrologic Model: Development and Forecast Modeling* (Stanislaus County, California) it states "data from nearby calibration wells suggests that in fact Orestimba Creek is groundwater connected and gaining in its middle and lower reaches". Because the question of ISWs is a data gap, it needs to be acknowledged and a plan to reconcile the data gap specified. Even though the streams may not be continuously connected, they may still be ISWs, and should be included in the Measurable Objectives.

<u>Checklist Item 27-29 – Minimum Thresholds (23 CCR §354.28</u>)

[Sections 6.3.1.2 Minimum Thresholds for Groundwater Levels (p. 6-5)]

- *[Our comment was not addressed. No changes to GSP text made.]* The GSP states that environmental use was considered when establishing the groundwater level minimum threshold; however, the criteria used was not included in the narrative. In addition, Table 6-1 (p. 6-9) does not identify which DMS ID corresponds to GDEs and, or ISWs. Please update this section to provide detail on criteria used to evaluate minimum thresholds for GDEs and ISWs, and to establish proposed thresholds, or a process for establishing thresholds in regards of protecting GDEs and ISWs.

[Section 6.3.3.2 Minimum Thresholds for Water Quality (p. 6-16)]

- *[Our comment was not addressed. No changes to GSP text made.]* Although agricultural water quality concerns were articulated, similar concerns were not identified for GDEs. Please include a discussion about GDEs and water quality, and how the minimum thresholds and interim milestones will help achieve the sustainability goal as it pertains to the environment.

[Sections 6.3.6.2 Minimum Thresholds for Interconnected Groundwater Surface Water Systems (p. 6-35)]

- *[Our comment was not addressed. No changes to GSP text made.]* The GSP states that depletions will be analyzed to determine the location, timing, and quantity of depletions from monitoring data collected between 2020 to 2025 and proposes a qualitative statement of no increased depletions. Please modify this section of the GSP to provide a statement that quantifies gains and, or losses similar to those shown in Table 5-9 (p. 5-172) as they relate to the 2015 conditions.

Checklist Item 30-46 – Undesirable Results (23 CCR §354.26)

[Section 6.3.1.1 Undesirable Results (for chronic lowering of groundwater levels) (p. 6-3)]

- *[Our comment was not addressed. No changes to GSP text made.]* This section only describes undesirable results relating to human beneficial uses of groundwater and neglects environmental beneficial uses that could be adversely affected by chronic groundwater level decline. Please add "potential adverse impacts to GDEs and ISWs" to the list of potential undesirable results presented in Section 6.3.1.1.

[Section 6.3.1.1.2 Identification of Undesirable Results (for chronic lowering of groundwater levels) (p. 6-4)]

- *[Our comment was not addressed. No changes to GSP text made.]* This section states that "..conditions are deemed significant and unreasonable, when groundwater elevations drop below the site-specific minimum threshold of 25% of representative monitoring wells in a principal aquifer…..in a given year". Please describe how a drop below the site-specific minimum threshold of 25% of representative monitoring wells in a principal aquifer relates to undesirable results. A specific threshold should be provided for monitoring wells that measure groundwater levels near GDEs.
- *[Our comment was not addressed. No changes to GSP text made.]* The GDE Pulse web application developed by TNC provides easy access to 35 years of satellite remote sensing data to view trends of vegetation metrics, groundwater depth (where available), and precipitation data. This satellite imagery can be used to observe trends for NC dataset polygons within and near the GSA. Over the past 10 years (2009-2018), some NC dataset vegetation polygons have experienced adverse impacts to vegetation growth and moisture along the San Joaquin River. An example screen shot from the GDE Pulse tool is presented under Checklist Items 11-15 above.
    - For each identifiable GDE unit with supporting hydrological datasets please include the following:
        - Plot and provide hydrological datasets for each GDE.
        - Define the baseline period in the hydrologic data.
        - Classify GDE units as having high, moderate, or low susceptibility to changes in groundwater.
        - Explore cause-and-effect relationships between groundwater changes and GDEs.
    - For each identifiable GDE unit without supporting hydrological datasets please describe data gaps and/or insufficiencies.
    - Compile and synthesize biological data for each GDE unit by including:

        - Plots of biological datasets for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.
        - Describe data gaps/insufficiencies.
    - Description of potential effects on GDEs, land uses, and property interests, including:
        - Cause-and-effect relationships between GDE and groundwater conditions.
        - Impacts to GDEs that are considered to be "significant and unreasonable".
        - Report known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities.
        - Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).
        - Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.

[Section 6.3.3.1.2 Identification of Undesirable Results (for degraded water quality) (p. 6-15)]

- *[Our comment was not addressed. No changes to GSP text made.]* This Section discusses MCLs and WQOs but does not include metrics for GDEs. Please modify this section to specifically address degraded water quality from TDS, As, B and other constituents that could pose a threat to wildlife and / or vegetative communities associated with GDEs and ISWs. Although As and CrVI are mentioned in this section, please add a statement addressing that overpumping and dewatering of aquitards has been identified as a potential source of elevated As concentrations above drinking water standards in San Joaquin Valley aquifers. The following is a link to a paper by Smith, Knight and Fendorf (2018) titled "Overpumping leads to California groundwater arsenic threat": (https://www.nature.com/articles/s41467-018-04475-3.

[Sections 6.3.6 Depletions of Interconnected Surface Water (p. 6-34)]

- *[Our comment was not addressed. No changes to GSP text made.]* The GSP states that depletions will be considered from monitoring data collected between 2020 to 2025. At a minimum the GSP should maintain the current level of ISWs until additional information is collected and measurable objectives and minimum thresholds can be more precisely defined. For example, Table 5-9 (p. 5-172) estimates the quantity of gains and depletions for reaches of the San Joaquin River only. This type of information should be used to support the statement of undesirable results and should be expanded to other streams that are potential ISWs. Please modify this section of the GSP to include a statement that there will be no increase in depletions for confirmed and potential ISWs, at least until data gaps are filled.

Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)

[Section 7.2.5.1 Groundwater Level Monitoring Network (p. 7-35)]

- *[Our comment was not addressed. No changes to GSP text made.]* The GSP proposes to use groundwater level monitoring for tracking chronic lowering of groundwater level and as a proxy for groundwater storage and depletion of interconnected surface waters. A set of representative wells has been selected in six subregions, shown in Figure 7-2 (p. 7-33). The representative wells to be used for monitoring groundwater levels in the semi-confined Upper Aquifer and the confined Lower Aquifer are shown in Figure 7-3 (p. 7-39) and Figure 7-4 (p. 7-40). Areas with spatial data gaps have been identified and are shown on both maps. The potential locations for wells for monitoring both aquifers are shown in Figures 7-5 and 7-6 (p. 7-47 and 7-48). Tables 7-6 and 7-7 (p. 7-37 and 7-38) indicate that some wells are missing key information, e.g. status, well depth or screened interval. Although a list of criteria including "adequate construction information" were listed on page 7-41, it appears that not all criteria were met in all the wells. A plan to fill these data gaps is included in Section 7.2.5.6.6 (Plan to Fill Data Gaps) that includes obtaining video logs of some wells and drilling new wells. Please emphasize in the text the importance of using dedicated monitoring wells with complete construction information in order to accurately monitor single aquifers.
- *[Our comment was not addressed. No changes to GSP text made.]* The GSP states on p. 7-45: "Not all wells included in these networks are dedicated monitoring wells, as recommended by DWR's Monitoring Networks and Identifications of Data Gaps BMP (2016a)." The GSP noted that an effort would be made to replace pumping wells with dedicated monitoring wells. Please discuss the importance of using dedicated monitoring wells instead of pumping wells at all locations.
- *[Our comment was not addressed. No changes to GSP text made.]* The GSP states on p. 7-45: "For the purpose of monitoring depletions of interconnected surface water, where groundwater levels are used as a proxy, four additional wells with tentative locations have been identified that would also be included in the groundwater level monitoring network. These wells are located within three miles of the San Joaquin River within the Northwestern Delta-Mendota GSA and Patterson Irrigation District GSA." Consideration should be given to using wells closer to the river or installing new wells. Please discuss how the data will be used to verify ISWs and quantify depletions of stream flow due to groundwater extraction.

[Section 7.2.5.6 Depletions of Interconnected Surface Water Monitoring Network (p. 7-67)]

- *[Our comment was not addressed. No changes to GSP text made.]* At present there are only two wells located within 3 miles of the San Joaquin River in the ISW area. Locations of four clustered wells have been identified and other stream gauging sites proposed as shown in Figure 7-11 (p. 7-73). Please expand on the discussion of how the new well and stream data will be used to improve ISW mapping and inform an adequate analysis. Please discuss how the data will be used to verify possible GDEs and reaches that include ISWs.

- *[Our comment was not addressed. No changes to GSP text made.]* As stated above in the comments for Checklist Items 8-10, please reconcile data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells) along westside ephemeral streams in this section of the GSP to improve ISW mapping in future GSPs.

<u>Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)</u>

[Section 7.1 Projects and Management Actions (p. 7-1)]

- *[Our comment was not addressed. No changes to GSP text made.]* The Subbasin includes many potential GDEs and ISWs (see our comments under Checklist Items 8-10 and 16-20 above) that are beneficial uses and users of groundwater and may include sensitive resources and protected lands. Environmental resource protection needs should be considered in establishing project priorities. In addition, and consistent with existing grant and funding guidelines for SGMA-related work, priority should be given to multi-benefit projects that can address water quantity and quality as well as providing environmental benefits or benefits to disadvantaged communities.
    - Although Table 7-2 (p. 7-5) provides information on how each project supports ISWs there are no criteria provided on how GDEs and ISWs were considered in project selection. Please include criteria considered for project selection as it relates to GDEs and ISWs.
    - In Section 7.1.1.1.1 (p. 7-9), the narrative supporting the Los Banos Creek Recharge and Recovery Project states that project beneficiaries are groundwater users but there is no discussion about how environmental users (i.e., GDEs and ISWs) will specifically benefit. Please update the environmental benefits and multiple benefits as criteria for assessing project priorities and articulate how project monitoring will support GDEs and ISWs.
    - Table 7-2 (pp. 7-5 to 7-8) identifies many important projects; however, the descriptions of objectives for each sustainability indicator for these projects only identify benefits to water level and storage. Since maintenance or recovery of groundwater levels, or construction of recharge facilities, may have potential environmental benefits in many cases it would be advantageous to demonstrate these multiple benefits from a funding and prioritization perspective. For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.
    - If ISWs will not be adequately protected or enhanced by those listed, please include and describe additional management actions and projects targeted for protecting known and potential ISWs.

- Recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such facilities have been incorporated into local Habitat Conservation Plans (HCPs) and Natural Community Conservation Plans (NCCPs), more fully recognizing the value of the habitat that they provide and the species they support. In addition, incorporating HCPs, NCCPs, and managed wetlands into recharge projects may effectively tie into the project's permitting strategy described in Section 7.1.5. For projects that construct recharge ponds, please update Table 7-4 (p. 7-21) to identify if there are multi-benefit opportunities that can incorporate habitat components into project designs and how the recharge ponds will be managed to benefit environmental uses and users.
- For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

[Section 7.1.1.2 Tier 1 Management Actions (p. 7-12)]

- *[Our comment was not addressed. No changes to GSP text made.]* This section discusses the Management Actions for GSP implementation and SGMA compliance; however, these actions are focused on meeting groundwater level and storage measures and do not include support for GDEs or ISWs. Please modify the Management Actions to include education and outreach for GDEs, ISWs and the sensitive habitats they support. Please update Section 7.1.1.2 Tier 1 Management Actions (p. 7-12) and Section 7.1.1.4 Tier 2 Management Actions (p. 7-15) to include GDEs and ISWs.

Attachment C

Freshwater Species Located in the San Joaquin Valley Delta Mendota Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Oxnard Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[3]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the CDFW's BIOS[4] as well as on TNC's science website[5].

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			

[3] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[4] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[5] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		SSC	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		SSC	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	BCC	SSC	BSSC - Third priority
Dendrocygna bicolor	Fulvous Whistling-Duck		SSC	BSSC - First priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	BCC	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	BCC	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		SSC	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		SSC	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		SSC	BSSC - Third priority
CRUSTACEANS				
Artemia franciscana	San Francisco Brine Shrimp			
Branchinecta conservatio	Conservancy Fairy Shrimp	Endangered	SSC	IUCN - Endangered

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Branchinecta lindahli	Versatile Fairy Shrimp			
Branchinecta longiantenna	Longhorn Fairy Shrimp	Endangered	SSC	IUCN - Endangered
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	SSC	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	SSC	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		SSC	IUCN - Near Threatened
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		SSC	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Pseudacris regilla	Northern Pacific Chorus Frog			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	SSC	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	SSC	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	SSC	ARSSC
Thamnophis atratus atratus	Santa Cruz Gartersnake			Not on any status lists
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis hammondii hammondii	Two-striped Gartersnake		SSC	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS AND OTHERS				
Aeshnidae fam.	Aeshnidae fam.			
Anax junius	Common Green Darner			
Brillia spp.	Brillia spp.			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Callicorixa spp.	Callicorixa spp.			
Capnia hitchcocki	Arroyo Snowfly			
Chironomus spp.	Chironomus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corisella spp.	Corisella spp.			
Cricotopus spp.	Cricotopus spp.			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Mesocapnia bulbosa	Bulbous Snowfly			
Paraleptophlebia associata	A Mayfly			
Paratanytarsus spp.	Paratanytarsus spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Procladius spp.	Procladius spp.			
Psectrocladius spp.	Psectrocladius spp.			
Tanypus spp.	Tanypus spp.			
Tipulidae fam.	Tipulidae fam.			
Trichocorixa spp.	Trichocorixa spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		SSC	
Margaritifera falcata	Western Pearlshell		SSC	
Pyrgulopsis diablensis	Diablo Range Pyrg		SSC	E
PLANTS				
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla filiculoides	NA			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Azolla microphylla	Mexican mosquito fern		SSC	CRPR - 4.3
Baccharis salicina				Not on any status lists
Bacopa eisenii	Gila River Water-hyssop			
Bidens laevis	Smooth Bur-marigold			
Bolboschoenus glaucus	NA			Not on any status lists
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Callitriche marginata	Winged Water-starwort			
Ceratophyllum demersum	Common Hornwort			
Chloropyron molle hispidum			SSC	CRPR - 1B.1
Chloropyron palmatum	NA	Endangered	SSC	CRPR - 1B.1
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Crypsis vaginiflora	NA			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus squarrosus	Awned Cyperus			
Downingia bella	Hoover's Downingia			
Downingia pulchella	Flat-face Downingia			
Echinodorus berteroi	Upright Burhead			
Elatine brachysperma	Shortseed Waterwort			
Elatine californica	California Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis atropurpurea	Purple Spikerush			
Eleocharis coloradoensis				Not on any status lists
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Eleocharis quadrangulata	NA			
Elodea canadensis	Broad Waterweed			
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eragrostis hypnoides	Teal Lovegrass			
Eryngium castrense	Great Valley Eryngo			
Eryngium racemosum	Delta Coyote-thistle		Endangered	CRPR - 1B.1
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle		SSC	CRPR - 1B.2
Eryngium vaseyi vallicola				Not on any status lists
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Juncus acuminatus	Sharp-fruit Rush			
Juncus xiphioides	Iris-leaf Rush			
Lasthenia ferrisiae	Ferris' Goldfields		SSC	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Lemna aequinoctialis	Lesser Duckweed			
Lemna gibba	Inflated Duckweed			
Lemna minor	Lesser Duckweed			
Lepidium jaredii jaredii	Jared's Pepper-grass		SSC	CRPR - 1B.2
Lepidium oxycarpum	Sharp-pod Pepper-grass			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limosella acaulis	Southern Mudwort			
Lipocarpha micrantha	Dwarf Bulrush			
Ludwigia peploides peploides	NA			Not on any status lists
Ludwigia repens	Creeping Seedbox			
Lythrum californicum	California Loosestrife			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Marsilea vestita vestita	NA			Not on any status lists
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus guttatus	Common Large Monkeyflower			
Montia fontana fontana	Fountain Miner's-lettuce			
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Myriophyllum aquaticum	NA			
Najas guadalupensis guadalupensis	Southern Naiad			
Navarretia heterandra	Tehama Navarretia			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Navarretia prostrata	Prostrate Navarretia		SSC	CRPR - 1B.1
Neostapfia colusana	Colusa Grass	Threatened	Endangered	CRPR - 1B.1
Panicum dichotomiflorum	NA			
Paspalum distichum	Joint Paspalum			
Persicaria hydropiperoides				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria pensylvanica	NA			Not on any status lists
Phacelia distans	NA			
Phyla lanceolata	Fog-fruit			
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Pluchea odorata odorata	Scented Conyza			
Pogogyne douglasii	NA			
Pogogyne zizyphoroides				Not on any status lists
Potamogeton diversifolius	Water-thread Pondweed			
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton nodosus	Longleaf Pondweed			
Potamogeton pusillus pusillus	Slender Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Psilocarphus tenellus	NA			
Puccinellia simplex	Little Alkali Grass			
Ranunculus sceleratus	NA			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rorippa palustris palustris	Bog Yellowcress			
Rotala ramosior	Toothcup			
Ruppia cirrhosa	Widgeon-grass			
Ruppia maritima	Ditch-grass			
Sagittaria longiloba	Longbarb Arrowhead			
Sagittaria montevidensis calycina				Not on any status lists
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus americanus	Three-square Bulrush			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Sinapis alba	NA			
Sparganium eurycarpum eurycarpum				
Stuckenia pectinata				Not on any status lists
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica americana	American Speedwell			
Wolffiella lingulata	Tongue Bogmat			
Zannichellia palustris	Horned Pondweed			
FISHES				
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	SSC	Vulnerable - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Pogonichthys macrolepidotus	Sacramento splittail		SSC	Vulnerable - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	SSC	Endangered - Moyle 2013
Acipenser transmontanus	White sturgeon		SSC	Vulnerable - Moyle 2013
Archoplites interruptus	Sacramento perch		SSC	Endangered - Moyle 2013
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Cottus asper ssp. 1	Prickly sculpin			Least Concern - Moyle 2013
Entosphenus tridentata ssp. 1	Pacific lamprey		SSC	Near-Threatened - Moyle 2013
Gasterosteus aculeatus microcephalus	Inland threespine stickleback		SSC	Least Concern - Moyle 2013
Hysterocarpus traskii traskii	Sacramento tule perch		SSC	Near-Threatened - Moyle 2013
Lampetra ayersi	River lamprey		SSC	Near-Threatened - Moyle 2013
Lampetra hubbsi	Kern brook lamprey		SSC	Vulnerable - Moyle 2013

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Lampetra richardsoni	Western brook lamprey			Near-Threatened - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		SSC	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		SSC	Near-Threatened - Moyle 2013
Mylopharodon conocephalus	Hardhead		SSC	Near-Threatened - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	SSC	Vulnerable - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus tshawytscha - CV fall	Central Valley fall Chinook salmon	SSC	SSC	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV late fall	Central Valley late fall Chinook salmon	SSC		Endangered - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Pogonichthys macrolepidotus	Sacramento splittail		SSC	Vulnerable - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013

Notes:
ARSSC = At-Risk Species of Special Concern
BCC = Bird of Conservation Concern
BSSC = Bird Species of Special Concern
CRPR = California Rare Plant Rank
IUCN = International Union for Conservation of Nature
SSC = Species of Special Concern

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[6] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[7]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

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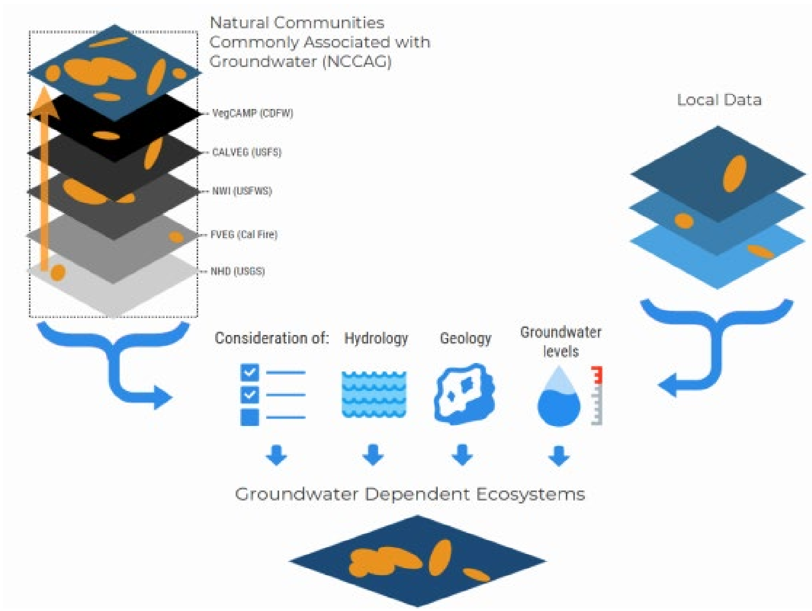
[6] *NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/*

[7] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf



The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[8]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[9] on the Groundwater Resource Hub[10], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may

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[8] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*
[9] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[10] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

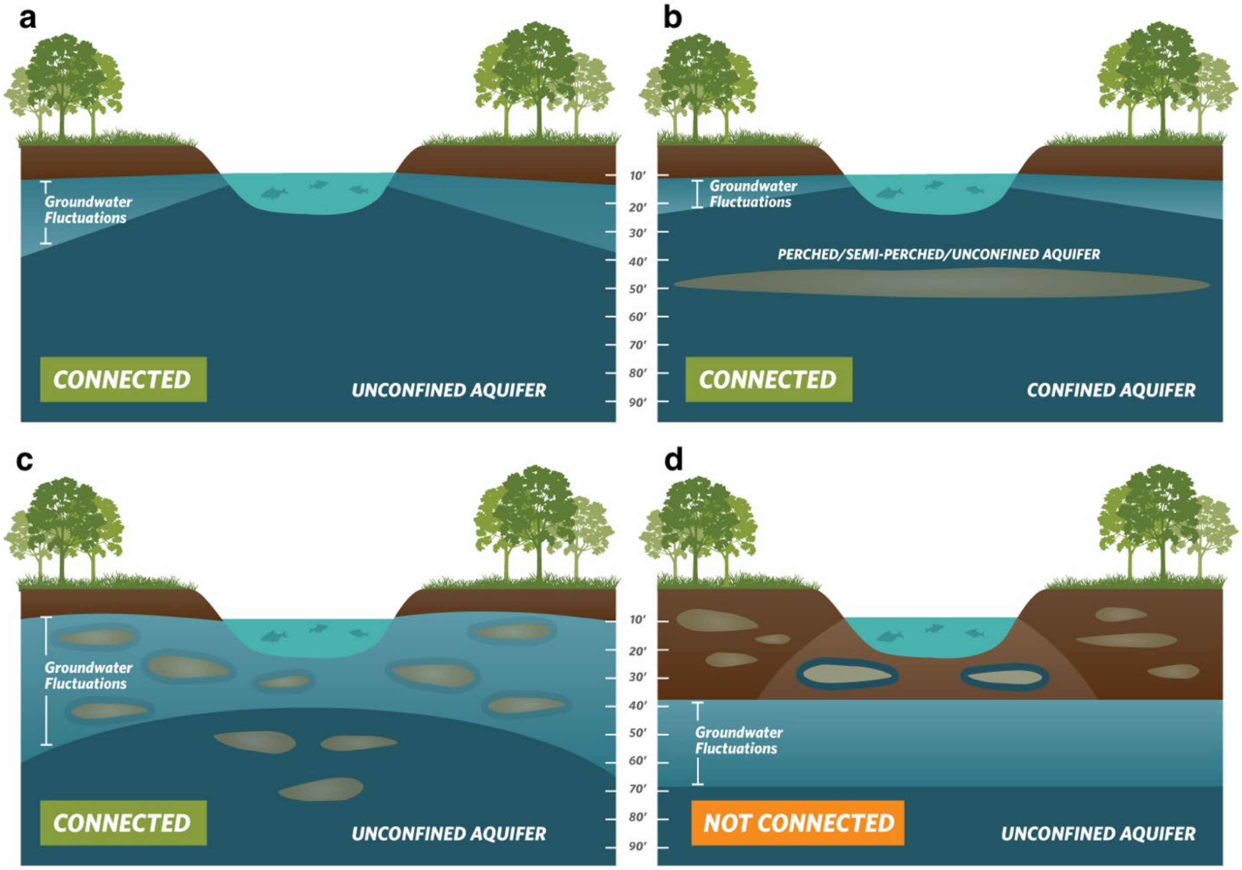

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[11] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[12] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[13] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[14]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network (see Best Practice #6).

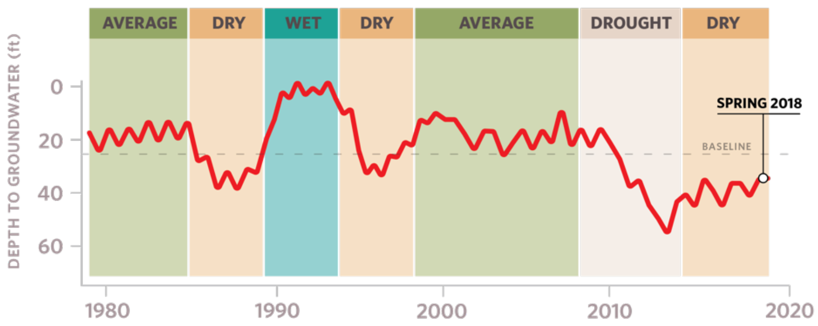

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[11] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[12] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[13] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[14] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[15], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

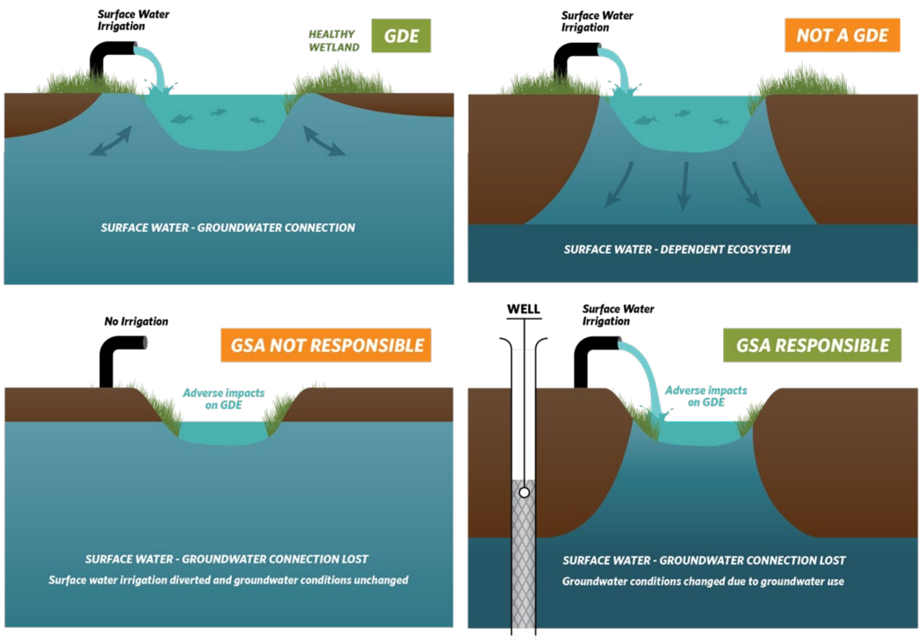

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[15] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

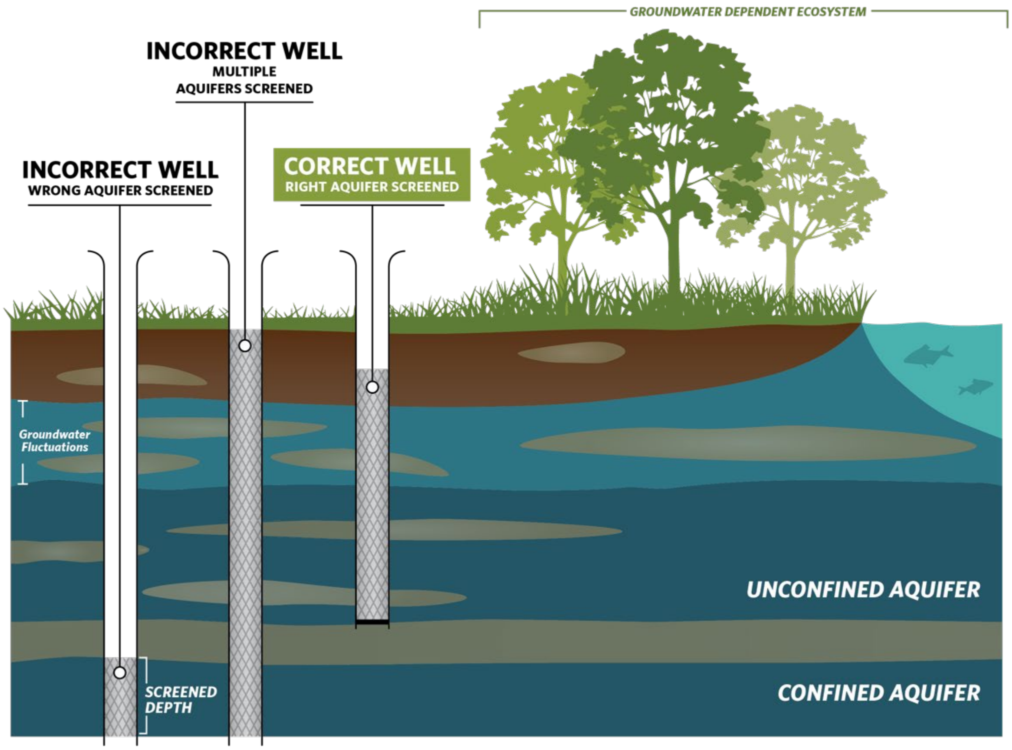

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[16] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

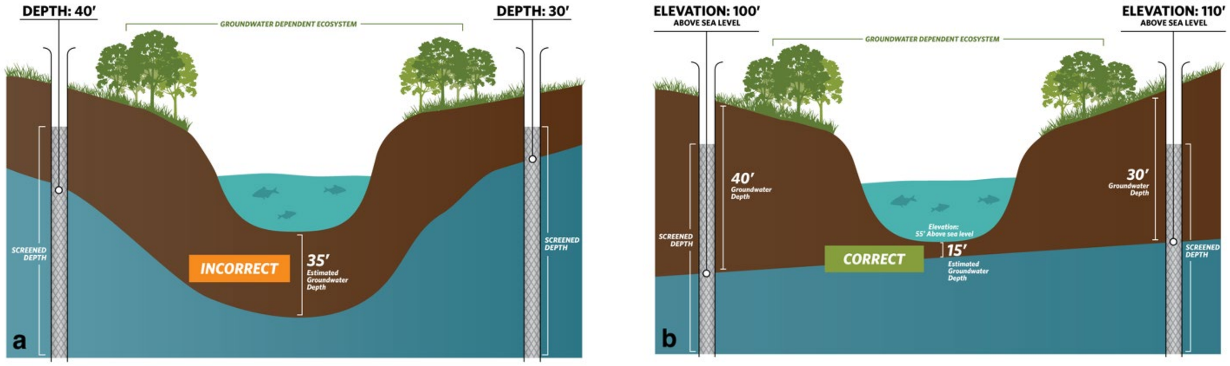

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

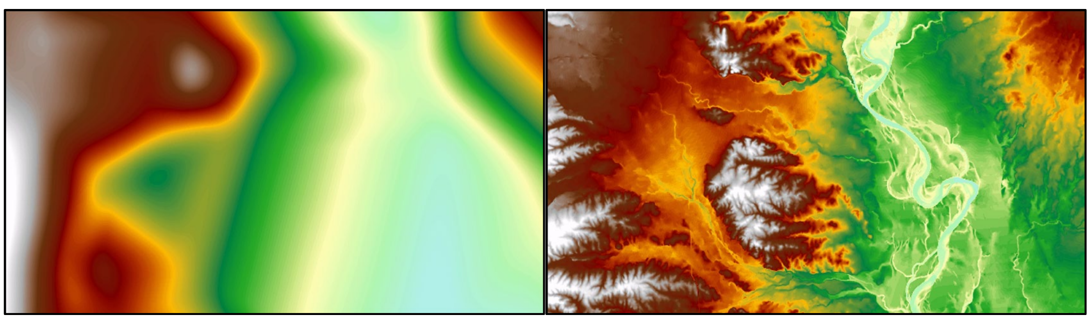

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[16] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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Visit
https://gde.codefornature.org/

Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[17]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[18]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[17] *The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#*

[18] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F

Mapping Likely Interconnected Surface Water
The Nature Conservancy, California, May 2020

Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, ISW is defined as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:
The groundwater elevation data, available for Spring 2011-2012, and Spring and Fall 2013-2018, comes from the California Department of Water Resources (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). These data are represented as continuous raster layers that approximates "feet above or below mean sea level" based on groundwater well measurements. According to the documentation online, groundwater level measurements were selected based on measurement date and well construction information (where available) and are intended to approximate the groundwater levels in the unconfined to uppermost semi-confined aquifers. Each of the raster layer has a different extent, but all of them are limited to the Central Valley. To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

The map splits groundwater depth into four categories:

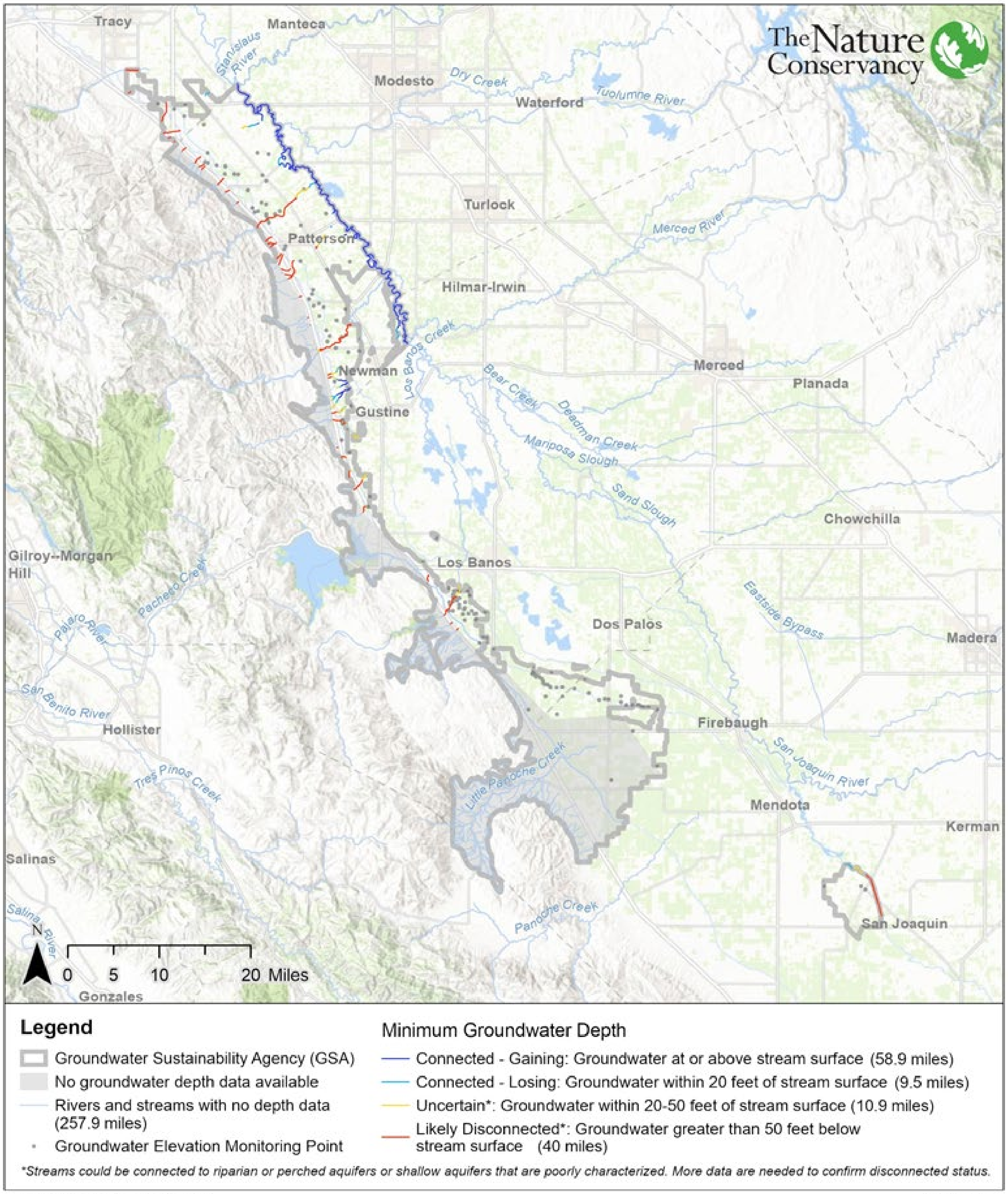
- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.
- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream

height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.

Interconnected Surface Water: Minimum Groundwater Depth (2011-2018)

Northern and Central Delta-Mendota Regions GSP



5-022.07_DeltaMendota_NorthCentral

Data Sources:
CA Dept. of Water Resources Groundwater Elevation Data, gis.water.ca.gov/app/gicima/
NHD Plus V2 Streams, nhdplus.com/NHDPlus/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[19]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[20]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[21] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[19] https://www.ncbi.nlm.nih.gov/pubmed/12753220
[20] Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009
[21] Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015

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nature.org
GroundwaterResourceHub.org

May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Paso Robles Subbasin Groundwater Sustainability Plan (GSP)

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Paso Robles Subbasin Groundwater Sustainability Agency's (GSA's) Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing *sustainable* groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be insufficient in addressing environmental beneficial uses and users.

The identification of environmental beneficial users, as well as their consideration when establishing the sustainability goal, undesirable results and minimum thresholds were insufficient (23 CCR §355.4(b)(4)) and lacked best available science (23 CCR §355.4(b)(1)). In the face of existing, severe overdraft, the GSP would allow groundwater management to largely ignore potential impacts to environmental beneficial users. This could result in irreparable harm to these beneficial users, undermining the intent of SGMA to achieve sustainability.

Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address within 180 days. In these cases, we strongly recommend that the Department, at a minimum, set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update. Should the treatment of environmental beneficial users be indicative of the quality of the overall plan, then we recommend the Department deem the plan inadequate.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We are disappointed to see the feedback that we provided on the draft GSP has been ignored in the final plan, as none of 41 comments were adequately addressed in the Final GSP. This indicates poor engagement of environmental beneficial users, which undermines the intent of SGMA to ensure that sustainability be defined locally with the participation of all users. Based on our experience the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan" (23 CCR §355.4(b)(10)).

TNC recommendation: We strongly recommend that DWR require the GSA to prioritize stakeholder engagement through improvements to their stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters (ISWs) – The GSP incorrectly excluded potential and/or actual ISWs because the plan did not employ the best available science. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). The assessment of potential ISWs is based on an incomplete groundwater level dataset that lacks sufficient characterization of shallow groundwater levels near streams, and appears to be based in part on the mistaken assumption that ephemeral streams cannot be ISWs. The regulations [23 CCR §351(o)] define interconnected surface waters (ISW) as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. Identification of ISWs is recognized as a data gap in the GSP, but the GSP does not outline any specific actions to address this important data gap.

TNC recommendation: TNC recommends that consideration be given to existing data gaps by installing shallow monitoring wells, stream gauges, and nested/clustered wells along surface water features to improve ISW mapping, characterization and management. Furthermore, until a disconnection can be proven, TNC recommends that the GSP include all potential and confirmed ISWs. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 375 acres of potential GDEs occur in the GSA boundary. TNC developed the Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

The plan does not to adequately identify, map and consider GDEs. We believe that this falls short of meeting plan evaluation criteria (1), (4) and (10), as defined in the 23 CCR §355.4(b). In addition, the Plan does not satisfy the requirement to identify GDEs (23 CCR §Section 354.16(g)) and consider beneficial users throughout the plan. Our review found that NC Dataset polygons were improperly removed from the GDE map based on the following:

- The analysis described in Appendix C of the GSP relies on groundwater levels at a single point in time (Spring 2017), which is *after* the January 1, 2015 SGMA benchmark date, and makes no further attempt to resolve questions of whether or not potential GDEs are groundwater connected or the degree to which they may be adversely affected by groundwater level declines. Furthermore, the GSP does not consider GDEs when defining undesirable results, minimum thresholds or measurable objectives. Finally, the groundwater monitoring data provided are insufficient to characterize the interaction between shallow groundwater and GDEs, the GSP does not establish monitoring networks capable of identifying potential undesirable results related to GDEs, and no specific plans are provided to address these data gaps.

<u>TNC recommendation</u>: The GSP utilizes groundwater levels that represent interannual and inter-seasonal variability along with additional information provided in Attachment D, which provides best practices for using the NC Dataset to identify and consider GDEs in the GSP. Specifically, please ensure that a Digital Elevation Model (DEM) is used when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment D.

Water Budget – We were disappointed to see that the water budget did not include the current, historical and projected demands of native vegetation and/or managed wetlands, as required under SGMA (23 CCR §354.18(a) and (b)(3)). The GSP only focused on a subset of water use sectors, such as urban and agricultural users of groundwater. This is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget nor will they likely be considered in project and management actions.

<u>TNC recommendation:</u> As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). This is problematic because without identifying

[1] Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. The Monitoring Network, which emphasizes groundwater level monitoring in deeper production aquifers and largely omits the alluvial aquifer and areas near potential GDEs and ISWs, is not sufficient to establish a linkage between groundwater extraction and resulting potential impacts to GDEs and ISWs. As a result, the monitoring network does not adequately characterize GDEs and other environmental beneficial users of surface water and groundwater.

TNC recommendation: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess potential impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but *sustainable* groundwater management that considers the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

<table>
<tr><td rowspan="11"></td><td rowspan="9"></td><td rowspan="3">If NC Dataset was used:</td><td>Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).</td><td>12</td></tr>
<tr><td>The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).</td><td>13</td></tr>
<tr><td>GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.</td><td>14</td></tr>
<tr><td>If NC Dataset was not used:</td><td>Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.</td><td>15</td></tr>
<tr><td colspan="2">Description of GDEs included:</td><td>16</td></tr>
<tr><td colspan="2">Historical and current groundwater conditions and variability are described in each GDE unit.</td><td>17</td></tr>
<tr><td colspan="2">Historical and current ecological conditions and variability are described in each GDE unit.</td><td>18</td></tr>
<tr><td colspan="2">Each GDE unit has been characterized as having high, moderate, or low ecological value.</td><td>19</td></tr>
<tr><td colspan="2">Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).</td><td>20</td></tr>
<tr><td rowspan="2">2.2.3
Water Budget
23 CCR §354.18</td><td colspan="2">Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.</td><td>21</td></tr>
<tr><td colspan="2">Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.</td><td>22</td></tr>
<tr><td rowspan="11">Sustainable Management Criteria</td><td rowspan="3">3.1
Sustainability Goal
23 CCR §354.24</td><td colspan="2">Environmental stakeholders/representatives were consulted.</td><td>23</td></tr>
<tr><td colspan="2">Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.</td><td>24</td></tr>
<tr><td colspan="2">Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.</td><td>25</td></tr>
<tr><td>3.2
Measurable Objectives
23 CCR §354.30</td><td colspan="2">Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.</td><td>26</td></tr>
<tr><td rowspan="3">3.3
Minimum Thresholds
23 CCR §354.28</td><td colspan="2">Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:</td><td>27</td></tr>
<tr><td colspan="2">Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?</td><td>28</td></tr>
<tr><td colspan="2">Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?</td><td>29</td></tr>
<tr><td rowspan="3">3.4
Undesirable Results
23 CCR §354.26</td><td colspan="2">For GDEs, hydrological data are compiled and synthesized for each GDE unit:</td><td>30</td></tr>
<tr><td rowspan="2">If hydrological data are available within/nearby the GDE</td><td>Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).</td><td>31</td></tr>
<tr><td>Baseline period in the hydrologic data is defined.</td><td>32</td></tr>
</table>

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Paso Robles Subbasin Groundwater Sustainability Plan

The Paso Robles Subbasin Groundwater Sustainability Plan (GSP), dated January 31, 2020, was reviewed by TNC. Public comments received on the draft GSP were included as Appendix N to the GSP. The comments are stated to have been reviewed by the Paso Roble Subbasin Groundwater Sustainability Agencies (PRSGSA) and changes incorporated into the GSP text as deemed appropriate by them; however, no response to comments were provided. We reviewed the text of the Final GSP to determine if changes were made to the Final GSP text that addressed TNC's previously submitted comments. This attachment lists our original comments on the complete Public Draft GSP, as submitted to the PRSGSA during the public comment period, and states whether or not they were addressed in the Final GSP *[as green text within brackets]*. Comments are provided in the order of the checklist items included as Attachment A.

<u>Checklist Item 1 - Notice & Communication (23 CCR §354.10)</u>

[Chapter 11 Notice and Communications (including separate Communications and Engagement Plan, Appendix M)]

- *[The PRSGSA did not address this comment. No GSP text changes were made.]* Section 3.0 of the Communications and Engagement Plan (Page 6) lists aquatic ecosystems as a beneficial groundwater use. **However, no details are given as to the types and locations of environmental uses and habitats supported, or the designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the subbasin. To identify environmental users, please refer to the following**:
    - Natural Communities Commonly Associated with Groundwater dataset (NC Dataset) - https://gis.water.ca.gov/app/NCDatasetViewer/
    - The list of freshwater species located in the Paso Robles Subbasin in **Attachment C** of this letter. Please take particular note of the species with protected status.
    - Lands that are protected as open space preserves, habitat reserves, wildlife refuges, etc. or other lands protected in perpetuity and supported by groundwater or ISWs should be identified and acknowledged.

<u>Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8</u>

[Section 3.6 Existing Monitoring Programs (p. 3-17)]

- *[The PRSGSA did not address this comment. No GSP text changes were made.]* Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater and *<u>related surface conditions</u>* (emphasis added). In order for this section to provide the appropriate context and help assure integration of GSP implementation with other ongoing regulatory programs, this section should describe the following:

- **Monitoring activities and responsibilities by State, Federal and local agencies and jurisdictions related to aquatic resources and GDEs that could be affected by groundwater withdrawals should be discussed.**
- The Critical Habitat for Threatened and Endangered Species website maintained by the US Fish and Wildlife Service (https://fws.maps.arcgis.com/home/webmap/viewer.html?webmap=9d8de5e265ad4fe09893cf75b8dbfb77) identifies lands with endangered and threatened species in the Basin, including species potentially associated with interconnected surface waters ISWs, including Steelhead (Onocorhynchus mykiss). Also please refer to the Critical Species Lookbook[2] to review and discuss the potential groundwater reliance of critical species in the basin. **Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.**

[Section 3.8.6 Requirements for New Wells (p. 3-30)]

- *[The PRSGSA did not address this comment. No GSP text changes were made.]* **Future well permitting must be coordinated with the GSP to assure achievement of the Plan's sustainability goals.**
- *[The PRSGSA did not address this comment. No GSP text changes were made.]* The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF v. SWRCB and Siskiyou County, No. C083239). **The need for well permitting programs to comply with this requirement should be stated.**

[Section 3.10 Land Use Plans (p. 3-31)]

- *[The PRSGSA did not address this comment. No GSP text changes were made.]* This section should include a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals. **Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, riparian areas, oak woodlands, aquatic resources and other GDEs and ISWs.**
- *[The PRSGSA did not address this comment. No GSP text changes were made.]* This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin and if they are associated with critical, GDE or ISW habitats. **Please identify all relevant HCPs and NCCPs within the Subbasin and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.**

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[2] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

Checklist Items 5, 6, and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 4.1 Subbasin Topography and Boundaries (p. 4-1)]

- *[The PRSGSA did not address this comment. No GSP text changes were made.]* Please provide additional information on what data was used to determine that "poor quality" groundwater in the Paso Robles Formation would exclude groundwater from being part of the subbasin.
- *[The PRSGSA did not address this comment. No GSP text changes were made.]* Defining the bottom of subbasin based on geochemical properties is a suitable approach for defining the base of freshwater, however, as noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** This will prevent the possibility of extractors with wells deeper than the basin boundary (defined by the base of freshwater) from claiming exemption of SGMA due to their well residing outside the vertical extent of the basin boundary.

[Section 4.7.2 Groundwater Discharge Areas Inside the Subbasin (p. 4-32)]

- We support the use of the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) to map groundwater dependent ecosystems in the Paso Robles Groundwater Basin (GSP Draft Figure 4-18). Since the NC Dataset is intended as a starting point, The Nature Conservancy has developed a Guidance Document to assist GSAs and their consultants in addressing GDEs in GSPs[3]. Also refer to **Attachment D** for best practices when using the NC dataset.
- *[The PRSGSA did not address this comment. No GSP text changes were made.]* The identification of GDEs within GSPs is a required GSP element of the Basin Setting Section under the description of Current & Historical Groundwater Conditions (23 CCR §354.16). Recognizing natural points of discharge (seeps & springs) as GDEs is consistent with the SGMA definition of GDEs;[4] **however, we recommend the identification of GDEs (GDE map Figure 4-18) for the Paso Robles basin be moved to Chapter 5: Groundwater Conditions, and elaborated upon with a description of current and historical groundwater conditions in the GDE areas.** Chapter 5 is a more appropriate place for the identification of GDEs, since groundwater conditions (e.g., depth to groundwater, interconnected surface water maps, groundwater quality) are necessary local information and data from the GSP in assessing whether polygons in the NC dataset are connected to groundwater in a principal aquifer.
- *[The PRSGSA did not address this comment. No GSP text changes were made.]* Decisions to remove, keep, or add polygons from the NC dataset into a basin GDE

[3] GDEs under SGMA: Guidance for Preparing GSPs is available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf
[4] Groundwater dependent ecosystem refer to ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. [23 CCR §351 (m)]

map should be based on best available science in a manner that promotes transparency and accountability with stakeholders. Any polygons that are removed, added, or kept should be inventoried in the submitted shapefile to DWR, and mapped in the plan. **We recommend revising Figure 4-18 to reflect this recommended methodology.**

[Section 5.2 Change in Groundwater Storage (p. 5-20)]

- *[The PRSGSA did not address this comment. No GSP text changes were made.]* Figure 5-11 illustrates that groundwater storage losses occurred during dry years and recovered in wet years. Potential impacts on groundwater storage loss due to groundwater pumping is still very possible, especially since groundwater pumping data has been estimated from groundwater flow models populated with insufficient vertical groundwater gradient data, shallow monitoring data, and surface flow data. Groundwater storage in the Paso Robles formation has also been on a decline since 1980 due to groundwater pumping (Figure 5-12). Understanding groundwater storage fluctuations in the Alluvial Aquifer depends on how vertical groundwater gradients are impacted by pumping and groundwater storage changes in the Paso Robles Formation. **Please address these data gaps in the monitoring network.**

<u>Checklist Items 8, 9, and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)</u>

[Section 5.5 Interconnected Surface Waters (p. 5-26)]

- *[The PRSGSA did not address this comment. No GSP text changes were made.]* **Please note the following best practices when filling the data gap in delineating any connections between surface water and groundwater.**
  - **Specify what data are used to determine the elevation of the stream or river bottom.**
  - The regulations [23 CCR §351(o)] define interconnected surface waters (ISW) as "surface water that is hydraulically connected <u>at any point</u> by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". **"<u>At any point</u>" has both a spatial and temporal component.** Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. ISWs can be either gaining or losing.
  - Due to limited shallow monitoring wells and stream gauges in the basin, **mapping ISWs are best estimated by first determining which reaches are completely disconnected from groundwater. This approach would involve comparing simulated groundwater elevations with a land surface Digital Elevation Model that could identify which surface waters have groundwater consistently below surface water features, such that an unsaturated zone would separate surface water from groundwater. Groundwater elevations that are always deeper than 50 feet below the land surface can be identified as disconnected**

surface waters. Also, please reconcile data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP to improve ISW mapping in future GSPs.

Checklist Items 11 to 20, Identifying, Mapping, and Describing GDEs (23 CCR §354.16)

[Appendix C: Methodology for Identifying Potential Groundwater Dependent Ecosystems]
[The PRSGSA did not address this comment. No GSP text changes were made.]

- For clarification, iGDEs are mapped polygons in DWR's NC dataset.
- **Please specify what field verification methods (e.g., isotope analysis, enhanced shallow groundwater monitoring) will be used to definitively determine whether potential GDEs are true GDEs.**
- **It is highly advised that multiple depth to groundwater measurements are used to verify whether an iGDE (or NC dataset polygon) is connected to groundwater, so that fluctuations in the groundwater regime can be adequately represented.** The analysis described on p.7 to create Figure C-3 only relies on Spring 2017 depth data, which is also after the Jan 1, 2015 SGMA benchmark date. Also, according to the shallow monitoring well data gaps described in Chapter 5 and 7, there is insufficient data to confidently remove data for NC polygons that are >5km away from a shallow well. See Attachment D of this letter for six best practices when using groundwater data to verify the NC dataset.
- **The NC dataset needs to be groundtruthed with aerial photography to screen for changes in land use that many not be reflected in the NC dataset (e.g., recent development, cultivated agricultural land, obvious human-made features).**
- Grouping multiple GDE polygons into larger units by location (proximity to each other) and principal aquifer will help to characterize GDEs under Section 4.7.2 and would simplify the process of evaluating potential effects on GDEs due to groundwater conditions under GSP Chapter 8: Sustainable Management Criteria.
- **Groundwater conditions within GDEs and the interaction between GDEs and groundwater should be briefly described within the portion of the Basin Setting Section (Section 4.7.2) where GDEs are being identified.**
- Not all GDEs are created equal. Some GDEs may contain legally protected species or ecologically rich communities, whereas other GDEs may be highly degraded with little conservation value. Including a description of the types of species (protected status, native versus non-native), habitat, and environmental beneficial uses (Refer to **Attachment C** for a list of freshwater species found in the Paso Robles Subbasin, refer to Worksheet 2, p.74 of GDE Guidance Document, and see the Critical Species Lookbook[5]) can be helpful in assigning an ecological value to the GDEs. **Identifying an ecological value of each GDE can help prioritize limited resources when considering GDEs as well as prioritizing legally protected species or habitat that may need special consideration when setting sustainable management criteria.**

[5] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

- Decisions to remove, keep, or add polygons from the NC dataset into a subbasin GDE map should be based on best available science in a manner that promotes transparency and accountability with stakeholders. Any polygons that are removed, added, or kept should be inventoried in the submitted shapefile to DWR, and mapped in the plan. **We recommend revising Figure 4-18 (replicated as Figure C-7) and including it in Chapter 5 to reflect this change. Please provide the final acreage of subbasin GDE polygons.**
- While depth to groundwater levels within 30 feet are generally accepted as being a proxy for confirming that polygons in the NC dataset are connected to groundwater, the variable needs of plant species and their dependence on seasonal and inter-annual groundwater level fluctuations should be considered when applying this criterion. Studies have found the roots of oaks can extend deeper than 70 feet to extract water from the capillary fringe immediately above the water table during the summer and fall, and that groundwater reserves provide a buffer to rapid changes in their hydroclimate, as long as groundwater reserves are not depleted by drought or human consumption.[6] **It is highly advised that seasonal and interannual fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one point in time or contoured with too few shallow monitoring wells can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs.** Based on a study we recently submitted to Frontiers in Environmental Science Journal, we've observed riparian forests along the Cosumnes River to experience a range in groundwater levels between 1.5 and 75 feet over seasonal and interannual timescales. Seasonal fluctuations in the regional water table can support perched groundwater near an intermittent river that seasonally runs dry due to large seasonal fluctuations in the regional water table. While perched groundwater itself cannot directly be managed due to its position in the vadose zone, the water table position within the regional aquifer (via pumping rate restrictions, restricted pumping at certain depths, restricted pumping around GDEs, well density rules) and its interactions with surface water (e.g., timing and duration) can be managed to prevent adverse impacts to ecosystems due to changes in groundwater quality and quantity under SGMA.

<u>Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)</u>

[Chapter 6. Water Budget (p. 6-1)]

- *[The PRSGSA did not address this comment. No GSP text changes were made.]* **Please clarify what assumptions and data were used to calculate Riparian Evapotranspiration**.
- *[The PRSGSA did not address this comment. No GSP text changes were made.]* Why was evapotranspiration only calculated for riparian vegetation? In Chapter 3.4.2 of the Draft GSP (p. 3-11), native vegetation was identified as the largest

[6] Miller and others. 2009. Groundwater Uptake by Woody Vegetation in a Semi-Arid Oak Savannah. Water Resources Research. Volume 46. November.

water use sector in the subbasin by land area. **Please estimate evapotranspiration for all native vegetation in the subbasin for the water budget. Environmental beneficial users of groundwater, such as wetlands and phreatophyte (oak) woodlands are of particular importance and should be explicitly mentioned. Calculations should be provided to quantify the amount of ET in the GDEs both spatially and temporally, including water year type. Please identify any data gaps.**

Checklist Items 23 to 46 – Sustainable Management Criteria

[Section 8.2 Sustainability Goal]

- *[The PRSGSA did not address this comment. No GSP text changes were made.]* This section states that the groundwater resources in the Paso Robles Subbasin will be managed for the long-term community, financial and environmental benefit of Subbasin users. The discussion of how this goal will be achieved references cultural, community and business needs and related management actions and projects to obtain sustainability, but provides no explanation how environmental beneficial uses will be protected. **Please describe how the sustainability of environmental groundwater and interconnected surface water uses will be protected, and what management actions and conceptual projects will address environmental beneficial uses and users of groundwater.**

[Section 8.3 General Process for Establishing Sustainable Management Criteria] *[The PRSGSA did not address this comment. No GSP text changes were made.]*

- Stakeholder involvement is crucial when establishing sustainable management criteria. The role of the GSA is to represent and balance the needs of *all groundwater* beneficial uses and users in the basin, which has been expressed in the Sustainability goal in Section 8.1. According to p. 8-5, only rural residents, farmers, local cities and the county were surveyed to gather input on sustainable management criteria. **Please specify what information or efforts have been used/made to protect the interests of environmental users and disadvantaged community members.**
- SGMA requires that sustainable management criteria are consistent with other state, federal or local regulatory standards [23 CCR§354.28(b)(5)]. No reference is made to the review of supporting documents for General Plan Conservation or Land Use Elements, or to the review of environmental management studies and documents such as Biological Assessments, Biological Opinions, HCPs, NCCPs, or other studies regarding the current and historical conditions of the beneficial uses being evaluated. **Please describe what process was used to identify other regulatory standards that need consideration when establishing minimum thresholds for sustainability criteria, especially those related to protected habitats, minimum flow requirements and habitat conservation plans. Please provide detail on how sustainable management criteria were developed for GDEs and streamflow habitat, and how the above supporting documents were considered.**

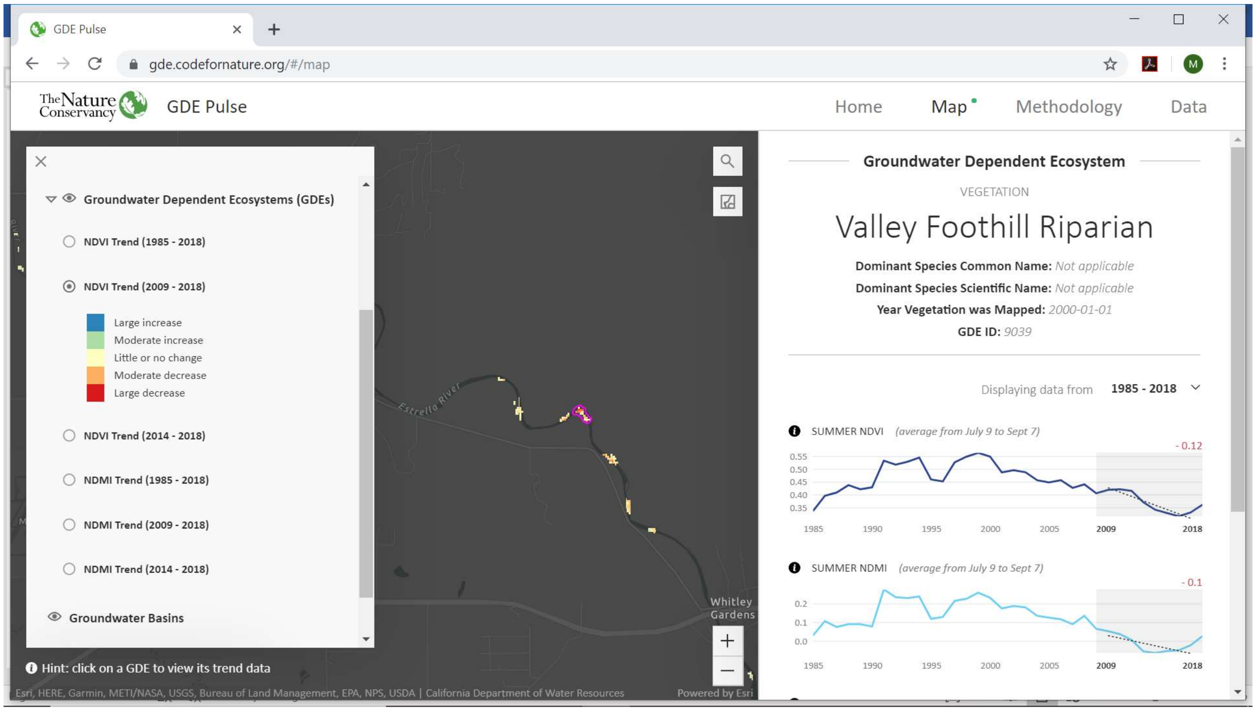
[Section 8.4 Chronic Lowering of Groundwater Levels Sustainable Management Criteria]

- *[The PRSGSA did not address this comment. No GSP text changes were made.]* [8.4.2] The definition of 'significant and unreasonable' is a qualitative statement that is used to describe when undesirable results would occur in the basin, which is then related to how a minimum threshold can be quantified. Potential effects on all beneficial users of groundwater in the basin need to be taken into consideration. According to the California Constitution Article X, §2, water resources in California must be "put to beneficial use to the fullest extent of which they are capable". **Please modify the local definition for 'significant and unreasonable' (provided on p. 8-7), so that it also specifies potential effects on environmental beneficial users of groundwater in the basin.**
- *[The PRSGSA did not address this comment. No GSP text changes were made.]* [8.4.3] Under SGMA, Measurable Objectives are to be established to achieve the sustainability goal of the basin within 20 years of Plan implementation [23 CCR § 354.30 (a)]. **Please modify the methodology for setting measurable objectives for groundwater levels so that it helps attain the sustainability goal defined on p. 8-4:** "sustainably manage the groundwater resources of the Paso Robles Subbasin for long-term community, financial, ***and environmental*** benefit of Subbasin users. … In adopting this GSP, ***it is the express goal of the GSAs to balance the needs of all groundwater users*** in the Subbasin, within the sustainable limits of the Subbasin's resources." (emphasis added)
    - Section 8.4.3.1 states that environmental interests were considered when establishing measurable objectives. **Please provide a discussion regarding the environmental beneficial uses and users that were considered and how this was accomplished.**
    - Section 8.4.3.2 and 8.4.3.3 present measurable objectives for specific wells completed in each principal aquifer, but provide no discussion how a determination was made that these groundwater levels are protective of environmental beneficial uses and users, including GDEs. **Chronic lowering of groundwater levels can have a direct effect on environmental beneficial users and this effect should be considered when setting measurable objectives for this sustainability indicator and discussed in this section and supporting materials provided. Section 8.4.3.1 should describe how environmental beneficial uses and users, including GDEs were considered when establishing measurable objectives for chronic lowering of groundwater levels. Section 8.4.3.2 and 8.4.3.3 should describe how the identified measurable objectives will succeed in preventing significant and unreasonable harm to environmental beneficial uses of groundwater, including GDEs.**
- *[The PRSGSA did not address this comment. No GSP text changes were made.]* [8.4.4] **Chronic lowering of groundwater levels can have a direct effect on environmental beneficial users and this effect should be considered when setting minimum thresholds for this sustainability indicator and discussed in this section and supporting materials provided.** A technically defensible approach is to use 10-year baseline period of groundwater elevation data (2005-2015) to establish how groundwater conditions during that time period affect different

beneficial water uses and users across the basin, including GDEs**. Please document the consideration of the following when establishing minimum thresholds for chronic lowering of groundwater levels:**

- The relationship between the minimum threshold for chronic lowering of groundwater levels and potential significant and unreasonable impacts to GDEs and ecological beneficial uses of surface water are not described. **Please provide additional analysis to substantiate that the potential impacts of applying the proposed minimum thresholds will not cause significant and unreasonable impacts to GDEs and ecological beneficial uses of ISW, or identify this as a data gap.**
- The potential effects of undesirable results on environmental beneficial users are not described and quantified. **Please expand the section to describe the potential effects of undesirable results on all beneficial uses and users, including environmental uses and users.**
- Are the proposed minimum thresholds consistent with other state, federal or local regulatory standards, including those applicable to interconnected surface waters, protected habitats and habitat conservation plans? [23 CCR§354.28(b)(5)]?
- Are there environmental beneficial groundwater users that need consideration, particularly those that are legally protected under the United States Endangered Species Act or California Endangered Species Act? (See **Attachment C** in the attached letter for a list of freshwater species located in the Paso Robles Subbasin)?

- *[The PRSGSA did not address this comment. No GSP text changes were made.]* The GDE Pulse web application developed by The Nature Conservancy (**Attachment E**) provides easy access to 35 years of satellite data to view trends of vegetation metrics, groundwater depth (where available), and precipitation data. This satellite imagery can be used to observe trends for NC dataset polygons within the Subbasin, and relate those trends to nearby groundwater level trends. Over the past 10 years (2009-2018), some NC dataset vegetation polygons have experienced adverse impacts to vegetation growth and moisture in the western portion of the Subbasin. An example is shown in the screen shot below. **Please review these spatial patterns and, where possible, correlate them with water level trends when developing minimum thresholds. Any indications of adverse trends and any data gaps should be identified.**



- *[The PRSGSA did not address this comment. No GSP text changes were made.]* [8.4.4.2] This section states that only one monitoring well was identified where minimum thresholds could be assessed in the Alluvial Aquifer. This is a significant data gap for a variety of beneficial uses and users, including GDEs and interconnected surface water. **Please describe a plan in the Monitoring network chapter on how the GSA will install shallow monitoring wells in the alluvial aquifer if confidentially agreements prevent existing wells from being used as representative monitoring wells for the Chronic Lowering of Groundwater sustainability indicator in this important aquifer.**
- *[The PRSGSA did not address this comment. No GSP text changes were made.]* [8.4.4.4 and 8.4.4.6] The description of how the groundwater elevation minimum thresholds affect interconnected surface waters and ecological land uses and users is inadequate for the following reasons:
    - The draft GSP has failed to describe current and historical groundwater conditions near GDE areas, the nature of the GDEs and their potential sensitivity to groundwater level declines, and the potential effect of groundwater level declines on GDEs. Thus, it is impossible to assess how the proposed minimum thresholds relate to historical groundwater conditions in the GDE and whether potential adverse effects could occur to the GDEs as a result of groundwater conditions. **Please include a discussion of how minimum thresholds will affect the GDEs identified in Appendix C and identify any data gaps.**
- *[The PRSGSA did not address this comment. No GSP text changes were made.]* [8.4.4.7] The identified GDEs have not been adequately described or characterized. Different GDE species will have different susceptibilities to groundwater level declines.

Please refer to the Critical Species Lookbook[7] to review and discuss the potential groundwater reliance of critical species in the basin. Legally protected species located with GDEs have not been identified. Thus, it is impossible to evaluate whether federal, state, or local standards exist for groundwater elevations needed to protect these listed species. **Please provide a discussion regarding how the selected minimum thresholds will affect compliance with federal, state and local standards related to protected habitats, protected species, and other requirements, such as biological opinions, habitat conservation plans and other applicable standards.**

- *[The PRSGSA did not address this comment. No GSP text changes were made.]* [8.4.4.9] Irreversible harm to GDEs can occur within a relatively short period of time. This section summarizes interim milestones to prevent chronic lowering of groundwater levels to achieve the sustainability goal by at least 2040. **Please discuss how significant and unreasonable harm to GDEs will be prevented in the interim.**
- *[The PRSGSA did not address this comment. No GSP text changes were made.]* [8.4.5.1 and 8.4.5.3] The GSP proposes to allow violation of minimum thresholds at a certain percentage of locations prior to considering threshold violations as representative of an undesirable result. As stated above, damage to GDEs is often irreversible, leading to the permanent loss of a protected resource. A percentage violation trigger may therefore be inadequate to assure that the sustainability goals of the GSP are met. **Please elaborate on how the exceedance criteria would be applied in a way that is protective of significant and unreasonable harm to GDEs. A procedure should be included for violation of minimum thresholds that includes early identification of potential GDE impacts and prioritization potentially impacted areas for investigation of impacts and appropriate response actions. This could be accomplished efficiently and cost-effectively through the use of remote sensing tools, such as GDE Pulse or other remote sensing approaches.**

[Section 8.9 Depletion of Interconnected Surface Water Sustainable Management Criteria] *[Note that this section is labeled 8.8 in the table of contents.]*

- *[The PRSGSA did not address this comment. No GSP text changes were made.]* The GSP fails to establish measurable objectives or minimum thresholds for this sustainability indicator, citing it as a data gap. The existence of riparian GDEs along the streams in the basin has been identified in Appendix C, and their connection to groundwater is assumed. Their occurrence in the riparian zone means that these GDEs should be considered a beneficial user of groundwater that could be affected by chronic groundwater level decline as discussed above, as well as beneficial users of surface water that could be depleted by groundwater extraction. **A more robust discussion of the known facts regarding these surface-groundwater interactions in the riparian zone should be provided. In addition, more detailed discussion regarding specific data gaps should be included. In our opinion, these changes are required in order for the GSP to be found adequate.**

[7] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

- *[The PRSGSA did not address this comment. No GSP text changes were made.]* [8.9.1] While there are certainly data gaps and a need for additional shallow monitoring wells in the Alluvial aquifer to map ISWs, there is also a need to enhancing monitoring of stream flow and vertical groundwater gradients. After filling the data gaps for ISWs and further analysis**, specific plans and schedules should be provided for the establishment of minimum thresholds for ISWs.**
- *[The PRSGSA did not address this comment. No GSP text changes were made.]* [8.9.2] There is a need to evaluate and discuss potential effects on beneficial uses of surface and groundwater. In addition, the applicable state, federal and local standards for the protection of aquatic, riparian and other protected habitats should be discussed. This is necessary, at a minimum, so that the nature of the data gaps can be understood. **Please refer to Attachment C for a list of freshwater species in Paso Robles Subbasin that may be exist within ISWs. We recommend that after identifying which freshwater species exist in your basin, especially federal and state listed species, that you contact staff at the Department of Fish and Wildlife (DFW), United States Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Services (NMFS) to obtain their input on the groundwater and surface water needs of the organisms on the freshwater species list. Because effects to plants and animals are difficult and sometimes impossible to reverse, we recommend erring on the side of caution to preserve sufficient groundwater conditions to sustain GDEs and ISWs. Please refer to the Critical Species Lookbook[8] to review and discuss the potential groundwater reliance of critical species in the basin.**

Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)

[Section 7.2.1 Groundwater Level Monitoring Network Data Gaps (p. 7-10)]
[The PRSGSA did not address this comment. No GSP text changes were made.]

- The last row of Table 7-3 states that "Data must be able to characterize conditions and monitor adverse impacts to beneficial uses and users identified within the basin". Aside from GDEs mapped in the basin (Figure 4-18), environmental surface water users have not been identified in the GSP thus far. SGMA requires that potential effects on GDEs and environmental surface water users be described when defining undesirable results. In addition to identifying GDEs in the basin, The Nature Conservancy recommends identifying beneficial users of surface water, which include environmental users. This is a critical step, as it is impossible to define "significant and unreasonable adverse impacts" without knowing what is being impacted, nor is possible to monitor ISWs in a way that can "identify adverse impacts on beneficial uses of surface water" [23 CCR §354.34(c)(6)(D)]. For your convenience, we've provided a list of freshwater species within the boundary of the Paso Robles basin in **Attachment C**. Our hope is that this information will help your GSA better evaluate and monitor the impacts of groundwater management on environmental beneficial users of surface water. We recommend that after identifying which freshwater species exist in your basin, especially federal and state listed species, that you

[8] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

contact staff at the Department of Fish and Wildlife (DFW), United States Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Services (NMFS) to obtain their input on the groundwater and surface water needs of the organisms on the freshwater species list, and how best to monitor them. Because effects to plants and animals are difficult and sometimes impossible to reverse, we recommend erring on the side of caution to preserve sufficient groundwater conditions to sustain GDEs and ISWs. **Please identify appropriate biological indicators that can be used to monitor potential impacts to environmental beneficial users as a current data gap and make plans to reconcile these in Chapter 10 (Plan Implementation).**

[Section 7.6.1 Interconnected Surface Water Monitoring Data Gaps (p. 7-25)]
[The PRSGSA did not address this comment. No GSP text changes were made.]

- In addition to the need for additional shallow monitoring wells in the Alluvial aquifer to map ISWs, **there is also a need to enhancing monitoring of stream flow and vertical groundwater gradients by installing more stream gauges and clustered/nested wells near streams, rivers or wetlands.** Ideally, co-locating stream gauges with clustered wells that can monitor groundwater levels in both the Alluvial and Paso Robles Formation aquifers would enhance understanding about where ISWs exist in the basin and whether pumping is causing depletions of surface water or impacts on beneficial users of surface water and groundwater.
- **There is a need to integrate biological indicators that can monitor adverse impacts to beneficial uses of surface water and groundwater within ISWs.**
- **Please provide sufficient detail for the investigation and monitoring program including stream gauges, screened intervals and aquifers of the shallow wells and frequency of monitoring, in order to describe monitoring of both the extent of ISWs and the quantity of surface water depletions from ISWs.**

[Chapter 10 Groundwater Sustainability Plan Implementation]

- *[Minor changes were made to the GSP text but do not adequately address this comment.]* **Please describe the expansion of the monitoring program and specify what types of monitoring will be done to identify impacts to GDEs. Be specific in describing wells and screened intervals that represent the water levels of both the Alluvial Aquifer and Paso Robles Formation Aquifer.**

<u>Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)</u>

[Chapter 9 Management Actions and Projects]
[The PRSGSA did not address this comment. No GSP text changes were made.] As stated in GSP Section 5.5, a data gap exists around interconnected surface waters (ISWs) in the Paso Robles Subbasin. Please recognize the data gap in this Chapter and the possibility that if ISWs are present in the Subbasin, there is a need to establish sustainable management criteria for ISWs in the basin and include ISWs as a specific sustainability indicator to be addressed by management actions and projects as described herein. **For the management actions and projects already identified, state how GDEs and ISWs will be benefited or protected. If GDEs and ISWs will not be adequately protected**

by those listed, please include and describe additional management actions and projects.

- An important data gap already recognized is the lack of publicly available groundwater elevation data in the Alluvial Aquifer. As discussed in TNC's comments on Section 8.3 above, a scientifically robust methodology must be proposed for establishing the initial minimum thresholds for the Alluvial Aquifer. **In light of the data gap regarding Alluvial Aquifer groundwater data, please be more specific in stating how GDEs and ISWs would benefit from management actions and projects, and how actions and projects will be evaluated to assess whether adverse impacts to GDEs will be mitigated or prevented**:
  - Promote Stormwater Capture (Page 9-10): Please describe how recharge from unallocated storm flows will be evaluated to assess benefits to GDEs and ISWs.
  - Mandatory Pumping Reductions (Page 9-13): Please discuss the data gap for wells screened in the alluvial aquifer and the data gap for vertical gradient between the alluvial aquifer and Paso Robles Formation, since most wells are screened in the Paso Robles aquifer. When these data gaps are resolved, it will become clearer how mandatory pumping reductions could also benefit GDEs and ISWs.
  - Conceptual Projects (Pages 9-18 to 9-44): Most of the conceptual projects involve in-lieu recharge for the direct use of recycled wastewater. Thus, the recycled water would replace pumped groundwater. Since these conceptual projects are location-specific, please highlight the benefits of these conceptual projects on specific mapped GDEs and ISWs.
- For more case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

Attachment C

Freshwater Species Located in the Paso Robles Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Paso Robles Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the Paso Robles groundwater basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[9]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[10] as well as on The Nature Conservancy's science website[11].

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
BIRD				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	SSC	BSSC - First priority
Aix sponsa	Wood Duck			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya collaris	Ring-necked Duck			
Aythya valisineria	Canvasback		SSC	
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			

[9] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[10] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[11] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Calidris mauri	Western Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Egretta thula	Snowy Egret			
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Icteria virens	Yellow-breasted Chat		SSC	BSSC - Third priority
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		SSC	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		SSC	BSSC - Third priority
CRUSTACEAN				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	SSC	IUCN - Vulnerable
Cyprididae fam.	Cyprididae fam.			
Hyalella spp.	Hyalella spp.			
Pacifastacus spp.	Pacifastacus spp.			
FISH				
Oncorhynchus mykiss - SCCC	South Central California coast steelhead	Threatened	SSC	Vulnerable - Moyle 2013
Catostomus occidentalis mnioltiltus	Monterey sucker			Least Concern - Moyle 2013
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Cottus gulosus	Riffle sculpin		SSC	Near-Threatened - Moyle 2013
Entosphenus tridentata ssp. 1	Pacific lamprey		SSC	Near-Threatened - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		SSC	Near-Threatened - Moyle 2013
Lavinia exilicauda harengeus	Monterey hitch		SSC	Vulnerable - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
Oncorhynchus mykiss - SCCC	South Central California coast steelhead	Threatened	SSC	Vulnerable - Moyle 2013
HERP				

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Actinemys marmorata marmorata	Western Pond Turtle		SSC	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus boreas halophilus	California Toad			ARSSC
Anaxyrus californicus	Arroyo Toad	Endangered	SSC	ARSSC
Pseudacris cadaverina	California Treefrog			ARSSC
Pseudacris hypochondriaca	Baja California Treefrog			
Pseudacris regilla	Northern Pacific Chorus Frog			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	SSC	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	SSC	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	SSC	ARSSC
Taricha torosa	Coast Range Newt		SSC	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		SSC	ARSSC
Thamnophis sirtalis infernalis	California Red-sided Gartersnake			Not on any status lists
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECT & OTHER INVERT				
Acentrella spp.	Acentrella spp.			
Agabus spp.	Agabus spp.			
Ambrysus mormon	Creeping water bug			Not on any status lists
Antocha spp.	Antocha spp.			
Argia emma	Emma's Dancer			
Argia lugens	Sooty Dancer			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetidae fam.	Baetidae fam.			
Baetis spp.	Baetis spp.			

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Berosus punctatissimus	Water scavenger beetles			Not on any status lists
Berosus spp.	Berosus spp.			
Callibaetis spp.	Callibaetis spp.			
Centroptilum spp.	Centroptilum spp.			
Chaetarthria bicolor	Water Scavenger Beetles			Not on any status lists
Chaetarthria ochra	Water Scavenger Beetles			Not on any status lists
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corisella spp.	Corisella spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Dytiscidae fam.	Dytiscidae fam.			
Enallagma civile	Familiar Bluet			
Enallagma cyathigerum	Common blue damselfly			Not on any status lists
Enochrus carinatus	Water Scavenger Beetles			Not on any status lists
Enochrus cristatus	Water Scavenger Beetles			Not on any status lists
Enochrus piceus	Water Scavenger Beetles			Not on any status lists
Enochrus pygmaeus	Water Scavenger Beetles			Not on any status lists
Enochrus spp.	Enochrus spp.			
Ephemerella spp.	Ephemerella spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Ephydridae fam.	Ephydridae fam.			
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Graptocorixa spp.	Graptocorixa spp.			
Gyrinus spp.	Gyrinus spp.			
Helichus spp.	Helichus spp.			
Helicopsyche spp.	Helicopsyche spp.			
Hetaerina americana	American Rubyspot			
Hydrochus spp.	Hydrochus spp.			
Hydrophilidae fam.	Hydrophilidae fam.			
Hydroporus spp.	Hydroporus spp.			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Hydryphantidae fam.	Hydryphantidae fam.			
Ischnura spp.	Ischnura spp.			
Laccobius ellipticus	Water scavenger beetles			Not on any status lists
Laccobius spp.	Laccobius spp.			
Laccophilus maculosus	Dingy Diver			Not on any status lists
Lepidostoma spp.	Lepidostoma spp.			
Leptoceridae fam.	Leptoceridae fam.			
Libellula saturata	Flame Skimmer			
Limnophyes spp.	Limnophyes spp.			
Liodessus obscurellus	Predacious Diving Beetle			Not on any status lists
Macromia magnifica	Western River Cruiser			
Malenka spp.	Malenka spp.			
Microcylloepus spp.	Microcylloepus spp.			
Microtendipes spp.	Microtendipes spp.			
Nectopsyche spp.	Nectopsyche spp.			
Ochthebius spp.	Ochthebius spp.			
Ophiogomphus bison	Bison Snaketail			
Optioservus spp.	Optioservus spp.			
Oreodytes spp.	Oreodytes spp.			
Paracloeodes minutus	A Small Minnow Mayfly			
Paracymus spp.	Paracymus spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Peltodytes spp.	Peltodytes spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Plathemis lydia	Common Whitetail			
Postelichus spp.	Postelichus spp.			
Procladius spp.	Procladius spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Psychodidae fam.	Psychodidae fam.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhyacophila spp.	Rhyacophila spp.			
Sigara mckinstryi	A Water Boatman			Not on any status lists
Sigara spp.	Sigara spp.			
Simuliidae fam.	Simuliidae fam.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sperchontidae fam.	Sperchontidae fam.			
Stictotarsus spp.	Stictotarsus spp.			
Sweltsa spp.	Sweltsa spp.			
Tanytarsus spp.	Tanytarsus spp.			

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Tipulidae fam.	Tipulidae fam.			
Tramea lacerata	Black Saddlebags			
Tricorythodes spp.	Tricorythodes spp.			
Wormaldia spp.	Wormaldia spp.			
MAMMAL				
Castor canadensis	American Beaver			Not on any status lists
MOLLUSK				
Gyraulus spp.	Gyraulus spp.			
Lymnaea spp.	Lymnaea spp.			
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Planorbidae fam.	Planorbidae fam.			
PLANT				
Alnus rhombifolia	White Alder			
Ammannia coccinea	Scarlet Ammannia			
Anemopsis californica	Yerba Mansa			
Azolla filiculoides	Mosquito Fern			
Baccharis salicina	Willow Baccharis			Not on any status lists
Bolboschoenus maritimus paludosus	Saltmarsh Bulrush			Not on any status lists
Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche marginata	Winged Water-starwort			
Castilleja minor minor	Alkali Indian-paintbrush			
Castilleja minor spiralis	Large-flower Annual Indian-paintbrush			
Cotula coronopifolia	Brass Buttons			
Crassula aquatica	Water Pygmyweed			
Crypsis vaginiflora	African Prickle Grass			
Cyperus erythrorhizos	Red-root Flatsedge			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis parishii	Parish's Spikerush			
Epilobium campestre	Smooth Boisduvalia			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle		SSC	CRPR - 1B.2
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Helenium puberulum	Rosilla			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Juncus dubius	Mariposa Rush			
Juncus effusus effusus	Common Bog Rush			
Juncus luciensis	Santa Lucia Dwarf Rush		SSC	CRPR - 1B.2
Juncus macrophyllus	Longleaf Rush			
Juncus xiphioides	Iris-leaf Rush			
Limosella aquatica	Northern Mudwort			
Marsilea vestita vestita	Hairy Waterclover			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Mimulus latidens	Broad-tooth Monkeyflower			
Mimetanthe pilosa	Snouted Monkey Flower			Not on any status lists
Montia fontana fontana	Fountain Miner's-lettuce			
Navarretia prostrata	Prostrate Navarretia		SSC	CRPR - 1B.1
Paspalum distichum	Joint Paspalum			
Persicaria lapathifolia	Common Knotweed			Not on any status lists
Persicaria maculosa	Spotted Ladysthumb			Not on any status lists
Phacelia distans	Common Phacelia			
Pilularia americana	Pillwort			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Ranunculus aquatilis diffusus	Whitewater Crowfoot			Not on any status lists
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rumex conglomeratus	Green Dock			
Rumex salicifolius salicifolius	Willow Dock			
Salix exigua exigua	Narrowleaf Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Schoenoplectus americanus	Three-square Bulrush			
Schoenoplectus pungens longispicatus	Three-square Bulrush			
Schoenoplectus pungens pungens	Common Threesquare			
Schoenoplectus saximontanus	Rocky Mountain Bulrush			
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	Water Speedwell			
Veronica catenata	Chain Speedwell			Not on any status lists
Notes: ARSSC = At-Risk Species of Special Concern BSSC = Bird Species of Special Concern CRPR = California Rare Plant Rank CS = Currently Stable SSC = Species of Special Concern				

Attachment D

July 2019

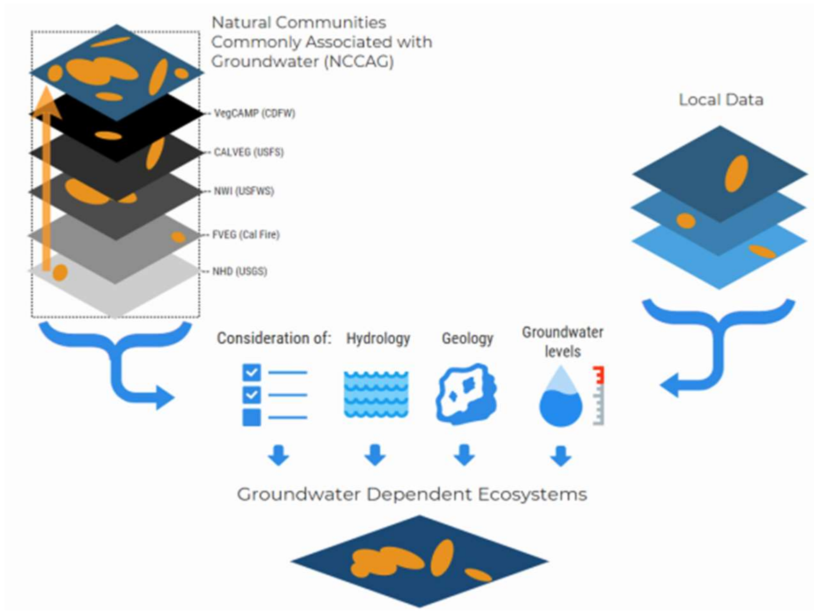
IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[12] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[13]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

[12] *NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/*

[13] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf



The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[14]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[15] on the Groundwater Resource Hub[16], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may

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[14] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[15] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[16] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

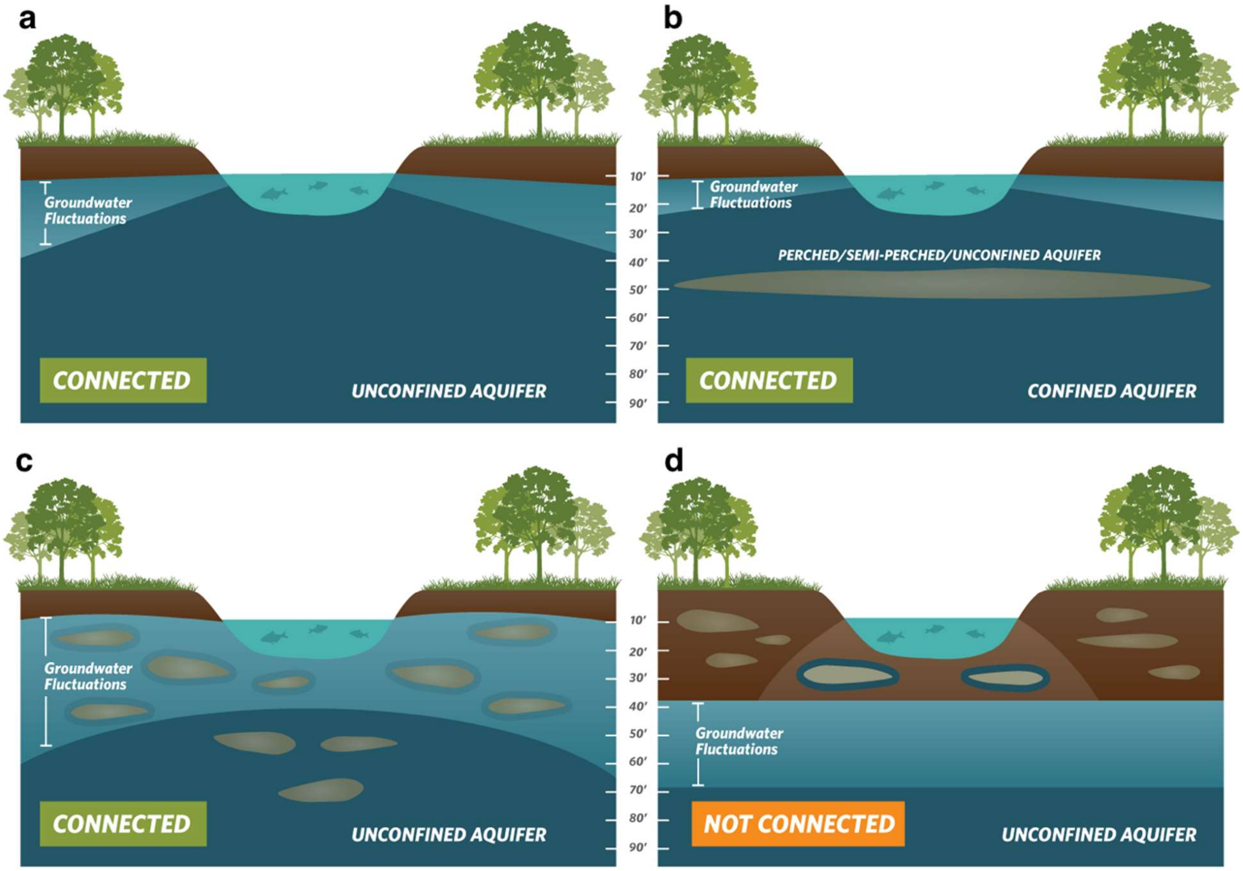

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[17] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[18] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[19] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[20]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

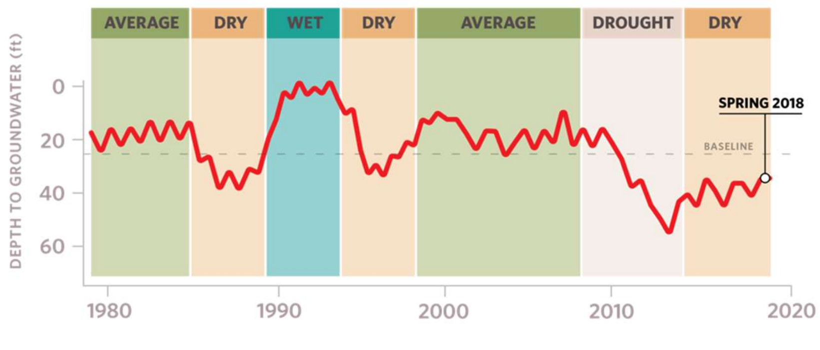

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[17] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[18] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[19] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[20] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[21], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

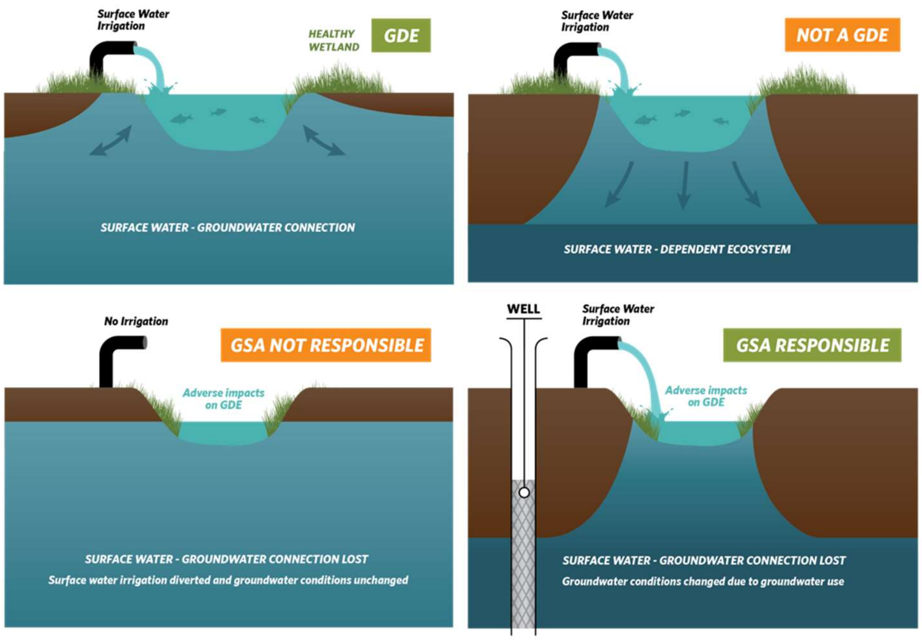

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[21] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

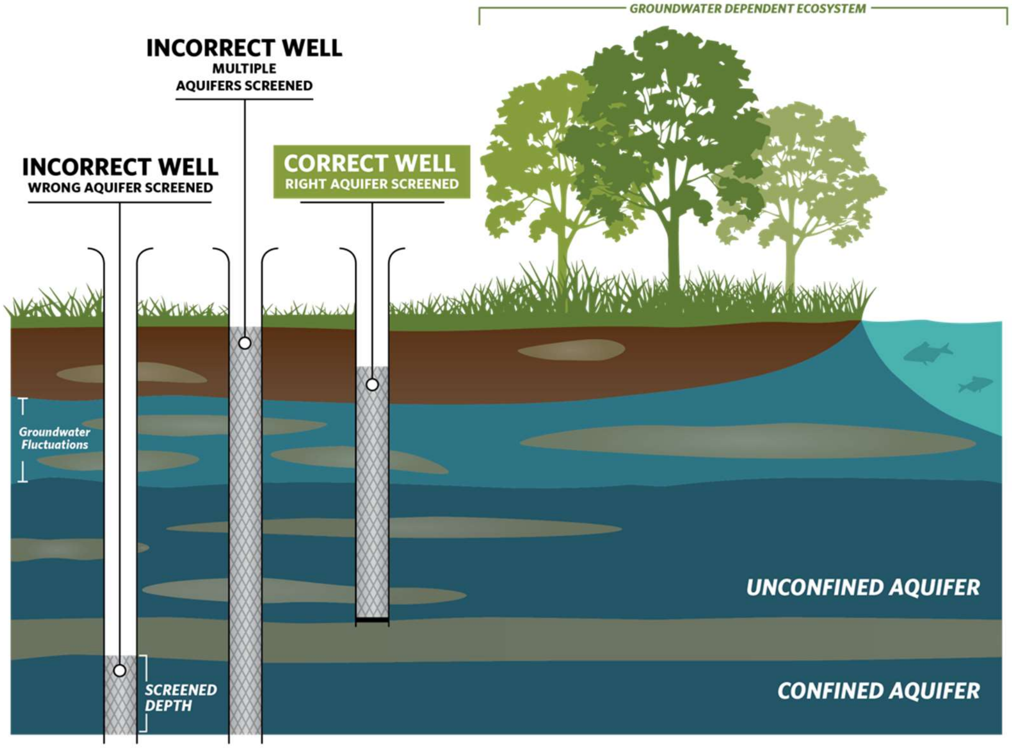

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[22] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

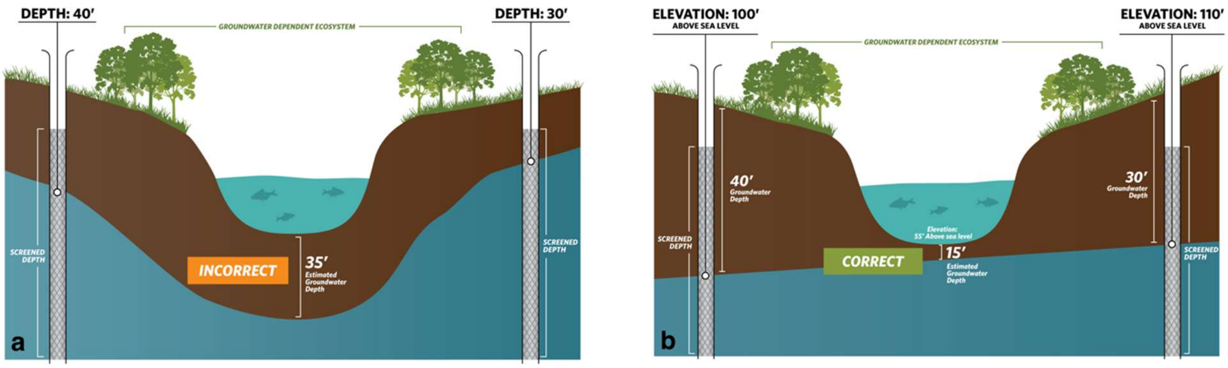

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

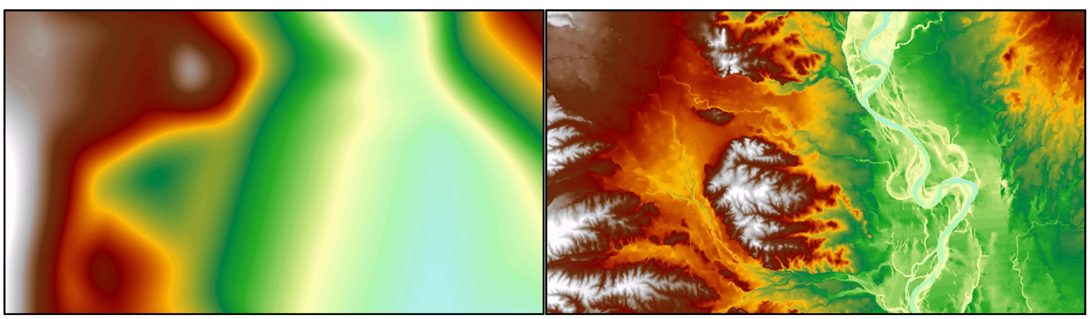

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[22] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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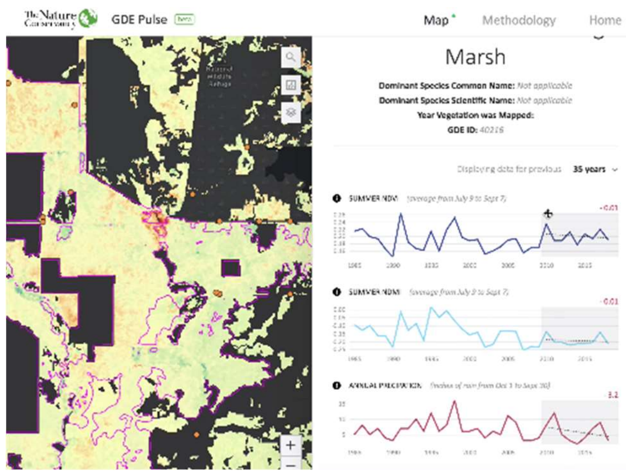

Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[23]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[24]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[23] *The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#*

[24] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[25]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[26]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[27] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

[25] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[26] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[27] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: 180/400-Foot Aquifer Subbasin Groundwater Sustainability Plan (GSP), 180/400-Foot Aquifer Subbasin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Salinas Valley Basin Groundwater Sustainability Agency's (GSA's) 180/400-Foot Aquifer Subbasin Groundwater Sustainability Plan (GSP or Plan), within the Salinas Valley Basin, prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing sustainable groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be insufficient in addressing environmental beneficial uses and users.

The identification of environmental beneficial users, as well as their consideration when establishing the sustainability goal, undesirable results, minimum thresholds and measurable objectives were insufficient (23 CCR §355.4(b)(4)) and lacked best available science (23 CCR §355.4(b)(1)). In the face of existing, severe overdraft, the GSP would allow groundwater management to largely ignore potential impacts to environmental beneficial users. This could result in irreparable harm to these beneficial users, undermining the intent of SGMA to achieve sustainability.

Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address within 180 days. In these cases, we strongly recommend that the Department, at a minimum, set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update. Should the treatment of environmental beneficial users indicate the quality of the overall plan, then we recommend the Department deem the plan inadequate.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides the GSA's response to TNC's comments on the Draft GSP.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We are disappointed to see the feedback that we provided on the draft GSP has been ignored in the final plan, as only 3 out of 47 of our comments were adequately addressed in the Final GSP. This indicates poor engagement of environmental beneficial users, which undermines the intent of SGMA to ensure that sustainability be defined locally with the participation of all users. Based on our experience the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan" (23 CCR §355.4(b)(10)).

TNC recommendation: We strongly recommend that DWR require the GSA to prioritize stakeholder engagement through improvements to their stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters (ISWs) – The GSP incorrectly excluded potential and/or actual ISWs because the plan did not employ the best available science. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). ISWs were inadequately analyzed based on the incorrect assertion that the shallow aquifer is not a principal aquifer, despite the recognition in the Basin Setting section of the GSP that the shallow aquifer supports domestic wells and is hydraulically connected to Salinas River. SGMA defines principal aquifers as "aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems" [23 CCR § 351 (aa)]. Groundwater in the shallow aquifer is likely to be supporting groundwater dependent ecosystems and interacting with the Salinas River in this basin. Even if pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers that can support springs, surface water, and groundwater dependent ecosystems. Because the GSP disregards the shallow aquifer as a principal aquifer, potential ISWs are not being identified, described, nor managed.

TNC recommendation: We recommend that the GSA include the shallow groundwater system as a principal aquifer in this GSP to ensure adequate monitoring and management of this critical groundwater resource upon which environmental beneficial users rely. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 9,071 acres of potential GDEs occur in the GSA boundary. TNC developed the *Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs*[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

The plan does not adequately identify, map and consider GDEs. We believe that this does not meet plan evaluation criteria (1), (4) and (10), as defined in the 23 CCR §355.4(b). In addition, the Plan does not satisfy the requirement to identify GDEs (23 CCR §Section 354.16(g)) and consider beneficial users throughout the plan. Our review found that NC Dataset polygons were improperly removed from the GDE map based on groundwater levels that were greater than 30-feet at a <u>single point in time</u>. This is a technically incorrect approach since groundwater levels fluctuate over seasonal and interannual time scales due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Justifying the removal of NC dataset polygons solely based on this criterion does not acknowledge that groundwater levels temporally vary and the fact that many plant species within GDEs can access groundwater depths beyond 30-ft or have adapted water stress strategies to deal with intermittent periods of deep groundwater levels. Using this methodology disregards groundwater fluctuations and can leave many GDEs unprotected in the GSP.

<u>TNC recommendation</u>: TNC recommends that the GSA utilize groundwater levels that represent interannual and inter-seasonal variability along with additional information provided in our BMP guidance document (Attachment D) to identify and consider GDEs throughout the GSP. Specifically, the GSA should use a Digital Elevation Model (DEM) when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment D.

Water Budget – We were disappointed to see that the water budget did not include the current, historical and projected demands of native vegetation and managed wetlands, as required under SGMA (23 CCR §354.18(a) and (b)(3)). For riparian evapotranspiration, the GSP only focused on evapotranspiration from non-native *Arundo donax*, which is not representative of native vegetation. This is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget nor will they likely be considered in project and management actions.

<u>TNC recommendation</u>: As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). Sustainable Management Criteria for groundwater levels do not consider the effects of potential groundwater level declines on

[1] *Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf*

GDEs. Sustainable Management Criteria for ISWs depend on model results that are updated on a 5-year cycle, thus lacking triggers to avoid undesirable results which leaves ecosystems vulnerable to decline. This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

<u>TNC recommendation</u>: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. As a result, the monitoring network does not adequately characterize GDEs and other environmental beneficial users of surface water and groundwater. The two shallow wells proposed along the Salinas River are inadequate to characterize groundwater conditions that support GDEs and ISWs across the entire subbasin. Because the GSP disregards the shallow aquifer as a principal aquifer, GDEs and ISWs are not being adequately addressed by the monitoring network in the GSP.

<u>TNC recommendation</u>: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess potential impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but sustainable groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Considering Nature under SGMA: A Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

<table>
<tr><th colspan="2">GSP Plan Element*</th><th colspan="2">GDE Inclusion in GSPs: Identification and Consideration Elements</th><th>Check Box</th></tr>
<tr><td>Admin Info</td><td>2.1.5
Notice & Communication
23 CCR §354.10</td><td colspan="2">Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.</td><td>1</td></tr>
<tr><td rowspan="3">Planning Framework</td><td rowspan="3">2.1.2 to 2.1.4
Description of Plan Area
23 CCR §354.8</td><td colspan="2">Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.</td><td>2</td></tr>
<tr><td colspan="2">Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.</td><td>3</td></tr>
<tr><td colspan="2">Summary of process for permitting new or replacement wells for the basin, and how the process incorporates protection of GDEs</td><td>4</td></tr>
<tr><td rowspan="8">Basin Setting</td><td rowspan="3">2.2.1
Hydrogeologic Conceptual Model
23 CCR §354.14</td><td colspan="2">Basin Bottom Boundary:
Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?</td><td>5</td></tr>
<tr><td colspan="2">Principal aquifers and aquitards:
Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?</td><td>6</td></tr>
<tr><td colspan="2">Basin cross sections:
Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?</td><td>7</td></tr>
<tr><td rowspan="5">2.2.2
Current & Historical Groundwater Conditions
23 CCR §354.16</td><td colspan="2">Interconnected surface waters:</td><td>8</td></tr>
<tr><td colspan="2">Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).</td><td>9</td></tr>
<tr><td colspan="2">Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.</td><td>10</td></tr>
<tr><td colspan="2">Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).</td><td>11</td></tr>
<tr><td>If NC Dataset was used:</td><td>Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).</td><td>12</td></tr>
</table>

			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological condition and variability are described in each GDE unit and adequate to describe baseline as of 2015.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment, beneficial uses and managed areas.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32
			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33

			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
180/400-Foot Aquifer Subbasin Groundwater Sustainability Plan
Comments based on Draft and Final GSPs

The 180/400-Foot Aquifer Subbasin GSP approved January 9, 2020 was reviewed by TNC. Public draft GSP comments and responses, provided as Appendix 11G of the GSP, were reviewed and are referred to below. The GSA response to our draft comment letter is also provided in Attachment F of this letter. This attachment lists our original comments on the complete public draft GSP as submitted to the GSA during the public comment period, and states whether or not they were addressed in the final GSP *[as green text within brackets]*. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

[Chapter 11. Outreach and Communication]

- *[The GSA's response states that more information on environmental users and interests has been added to Chapter 11. However, specific environmental users of groundwater have not been added to the GSP. Please identify freshwater species located in the 180/400-Foot Aquifer Subbasin as provided in Attachment C of this letter.]* The Joint Exercise of Powers Agreement (Appendix 11D) lists the Board of Directors that includes a Director representing environmental users and interests. This is the only mention of environmental users in Chapter 11. No details are given as to the types and locations of environmental uses and habitats supported, or the designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the Subbasin. **To identify environmental users, please refer to the following**:
    - Natural Communities Commonly Associated with Groundwater dataset (NC Dataset) – (https://gis.water.ca.gov/app/NCDatasetViewer/) which identifies the potential presence of groundwater dependent ecosystems in this basin.
    - The list of freshwater species located in the 180/400-Foot Aquifer Subbasin in **Attachment C** of this letter. Please take particular note of the species with protected status.
    - Lands that are protected as open space preserves, habitat reserves, fisheries, wildlife refuges, conservation areas or other lands protected in perpetuity and supported by groundwater or ISWs should be identified and acknowledged.
- *[This comment was not listed in the Response to Comments provided in Appendix 11G. No changes to the GSP text were made.]* Please refer to the Critical Species Lookbook[2] to review and discuss the potential groundwater reliance of critical species in the basin. **Please include a discussion regarding the**

[2] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

management of critical habitat for these aquatic species and its relationship to the GSP.

Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8)

[Section 3.10 Land Use Plans (p. 3-31 to 3-40)]

- *[The GSA's response states: "Section 3.10.7 discusses plan implementation effects on existing land uses." However, our comment was not addressed by GSP text changes.]* This section discusses the city (Salinas, Gonzales, and Marina) and county (Monterey) general plans covering areas within the Subbasin. **Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs.**
- *[The GSA's response states: "The Salinas River HCP is addressed in Chapter 8. No NCCPs have been developed to our knowledge." Thank you for pointing out the location in the text that discusses the Salinas River HCP. For clarity please add a statement regarding NCCPs to the GSP.]* This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin and if they are associated with critical, GDE or ISW habitats. **Please identify all relevant HCPs and NCCPs within the Subbasin and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.**
- *[The GSA's response states: "Comment noted. This is not relevant to the general plans discussion." Please find another location in the GSP to discuss the management of aquatic species that rely on groundwater.]* Please refer to the Critical Species Lookbook[3] to review and discuss the potential groundwater reliance of critical species in the basin. **Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.**

[Section 3.3 Jurisdictional Areas (p. 3-4 to 3-6)]

- *[The GSA's response states: "Salinas River HCP is addressed in Chapter 8. This is the only known flow requirement for aquatic species." For clarity please refer to the Salinas River HCP within Section 3.3 under the appropriate jurisdictional area.]* The GSP describes several wildlife refuges, reserves, and conservation areas under Federal and State Jurisdiction, however there is no discussion of any in-stream flow requirements or other protections in place for species in these critical areas. **Please include a discussion regarding the management of critical habitat for aquatic species and its relationship to the GSP, including discussion of any in-stream flow requirements.**

[Section 3.10.5 Well Permitting (p. 3-38)]

- *[The GSA's response states: "There is no plan to modify the well permitting system." This response does not address our comment and no changes to the GSP text were made.]* The GSP includes a brief discussion of well permitting policies governed by

[3] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

Monterey County. **Please include a discussion of how future well permitting will be coordinated with the GSP to assure achievement of the Plan's sustainability goals.**

- *[Our comment was addressed through GSP text changes. Thank you for acknowledging the impact of groundwater withdrawals on public trust resources.]* The State Third Appellate District recently found that counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF v. SWRCB and Siskiyou County, No. C083239). **Compliance of well permitting programs with this requirement should be stated in the GSP.**

Checklist Items 5, 6, and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 4.3.2 Vertical Subbasin Boundaries (p. 4-10)]

- *[The GSA's response states: "This GSP has adopted the USGS definition of the bottom of the aquifer for consistency." This response disregards DWR guidance and does not address our comment. No changes to the GSP text were made.]* The SVBGSA has adopted the base of the aquifer defined by the USGS (Durbin et al., 1978). However, as noted on page 9 in DWR's Hydrogeologic Conceptual Model BMP[4] "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data, as part of the best available data available to the GSA, should also be included in the determination of the basin bottom. This will prevent extractors with wells deeper than the basin boundary from claiming exemption of SGMA due to their well residing outside the vertical extent of the basin boundary.**

[Section 4.4 Subbasin Hydrogeology (p. 4-13)]

- *The GSA's response states: "Per SGMA regulations, these cross sections illustrate the current understanding of the regional, principal aquifers. Near-surface cross sections are not required by SGMA, and it is unclear that adequate data exists to construct realistic near-surface cross sections." If data is unavailable to draw cross sections that include all principal aquifers, including the shallow aquifer, please identify this as a data gap in the GSP.]* Regional basin-wide geologic cross sections are provided in Figures 4-6 through 4-8 (p. 4-14 to 4-16). These cross-sections do not include a graphical representation of the manner in which the shallow aquifer may interact with ISWs or GDEs that would allow the reader to understand this topic. **Please include example near-surface cross section details that depict the conceptual understanding of shallow groundwater and stream interactions at different locations.**

[Section 4.4.1 Principal Aquifers and Aquitards (p. 4-17)]

[4] Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf, accessed Feb 6, 2019.

- *[The GSA's response states: "Comment noted." This does not address our comment and no changes to the GSP text were made.]* SGMA defines principal aquifers as "aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems" [23 CCR § 351 (aa)]. The GSP states (p. 4-17): "The shallowest water-bearing sediments are thin, laterally discontinuous, and do not constitute a significant source of water for the Subbasin. These shallow sediments are therefore not considered a principal aquifer." The text goes on to state that some domestic wells draw water from this zone, and that groundwater in these sediments is hydraulically connected to the Salinas River, both statements further support the claim that the shallow aquifer is a principal aquifer. **TNC disagrees with the statement that the shallow aquifer is not a principal aquifer; it is indeed a principal aquifer that needs Sustainable Management Criteria established to prevent adverse impacts to GDEs and surface water beneficial users.**

<u>Checklist Items 8, 9, and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)</u>

[5.6.1 Data Sources for Interconnected Surface Water (5-56)]

- *[The GSA's response states: "Because the shallow sediments are not a principal aquifer, they are not evaluated in this GSP. The sustainable management criteria state that there will not be any increased depletion of surface water from the Salinas River due to pumping from the 180 for 400-Foot aquifers." TNC disagrees with the statement that the shallow aquifer is not a principal aquifer. No changes to the GSP text were made.]* While groundwater in the 180- and 400-foot Aquifers is generally not considered to be hydraulically connected to the Salinas River or its tributaries, the Shallow Aquifer (which resides above the Salinas Valley Aquitard) likely does. **To address this, interconnections of surface water with groundwater in the Shallow Aquifer should be evaluated in this section of the GSP, since the Shallow Aquifer is within the 180/400-Foot Aquifer Subbasin. Where data gaps exist, cite them here or refer to a subsequent section of the GSP. Cite cross-sections that relay the conceptual understanding of the shallow aquifer interaction with surface water.** Groundwater in the shallow aquifer is also likely to be supporting groundwater dependent ecosystems and interacting with the Salinas River in this part of the basin. Basins with a stacked series of aquifers may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, that can support springs, surface water, and groundwater dependent ecosystems. This is because the goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits, and while groundwater pumping may not be currently occurring in a shallow aquifer, it could be in the future.

[Section 5.6.2 Analysis of Surface Water and Groundwater Interconnection (p. 5-58)]

- *[This comment was not listed in the Response to Comments provided in Appendix 11G. No changes to the GSP text were made.]* The 180-Foot Aquifer and the 400-Foot Aquifers are confined units, thus comparing groundwater levels of <20 feet below the ground surface with wells screened within a confined aquifer is an incorrect comparison. This is because the potentiometric surface of a confined aquifer cannot reflect the position of the true water table. **Comparing groundwater levels from the shallow (unconfined) aquifer (that exists above the Salinas Valley Aquitard) with the ground surface is a more appropriate approach for identifying ISWs in the basin.**
- *[The GSA's response is "Comment noted. Our ability to identify areas of interconnected surface water will be improved when the SVIHM becomes available." Please elaborate on this statement in the GSP text.]* **Mapping ISW locations would be best done using contours of depth to groundwater measured from multiple points in time (different seasons and water year types) rather than only from Fall 2013. Groundwater conditions evaluated across the range of seasonal and interannual time frames provides a more representative view of ISWs.** Relying solely on any single point in time (in this case Fall 2013) to characterize groundwater conditions (e.g., depth to groundwater) is incomplete because data from one time point fails to capture the seasonal and interannual variability (i.e., wet, average, dry, and drought years) that is characteristic of California's climate. If data gaps exist in groundwater level contour data over time, these data gaps should be discussed in the ISP Section 5.5 (Salinas Valley Basin ISP) and GSP Section 5.6 (180/400-Foot Aquifer GSP Draft) and reconciled in the Monitoring Network section, so that ISW maps can be improved in future GSPs.
- *[The GSA's response states: "These are maps of groundwater levels in the principal aquifers." TNC disagrees with the statement that the shallow aquifer is not a principal aquifer. No changes to the GSP text were made.]* **The groundwater levels shown on Figure 5-37 are irrelevant to the discussion of ISWs since they do not map the shallow water table. The use of piezometric head from confined aquifers should be eliminated from these ISW mapping efforts, since they do not adequately reflect the position of the true water table (see last paragraph on p. 38 of Salinas Valley Basin ISP).**
- *[The GSA's response states: "The groundwater level maps were adopted from MCWRA, who does not provide well locations for their maps. In accordance with SGMA regulations, future groundwater elevation maps will provide well locations." Please clarify this in the GSP text.]* It is unclear on Figure 5-37 whether missing groundwater levels along certain reaches of the Salinas River are due to groundwater levels >20 feet bgs or due to data gaps in groundwater levels. Mapping the position of wells used for the interpolation of groundwater elevation data used to map groundwater level contours near surface water would help provide further clarification.
- *[The GSA's response states: "Groundwater contours were adopted directly from maps previously developed by MCWRA. These previously developed maps were considered the best available data for historical groundwater level contours." Please clarify this in the GSP text.]* **Please elaborate on how depth to groundwater contours were developed for Figure 5-19 of the Salinas Valley Basin ISP and**

on Figure 5-37 of the GSP. More accurate depth to groundwater maps around surface water features can be obtained by first interpolating groundwater elevations around surface water features and then subtracting groundwater elevations from land surface elevation data (obtained via digital elevation maps (DEM)[5]) for more accurate ISW mapping.

<u>Checklist Items 11 to 15, Identifying and Mapping GDEs (23 CCR §354.16)</u>

[4.4.4 Natural Discharge Areas (p. 4-23)]
[Appendix 4A Methodology for Identifying Potential Groundwater Dependent Ecosystems]

- *[The GSA's response states: "Figure 5-35 is a depth to groundwater map. As noted in Appendix 4A, the conservative approach to identifying potential GDEs used in this GSP clearly has the potential to overestimate the number of GDEs in the Subbasin." TNC does not agree that the method used in Appendix 4A is a conservative approach. A conservative approach would be one that retained GDEs until data gaps are reconciled. No changes to the GSP text were made.]* Please present or refer to a depth to groundwater map in this section. Refer to our comments on Section 5.6 Interconnected Surface Water above. Please ensure that only wells screened in the shallow unconfined aquifer are used to develop the depth to groundwater maps. Using "depth to groundwater" measurements from confined aquifers is mapping piezometric head of the confined aquifer and not detecting groundwater conditions in the unconfined aquifer that is supporting the ecosystem. The GSP refers to data gaps in water levels in the shallow unconfined aquifer. **If there are insufficient groundwater level data in the shallow aquifer, then the GDE polygons in these areas should be included as GDEs in the GSP *<u>until</u>* data gaps are reconciled in the monitoring network.**
- *[This comment was not listed in the Response to Comments provided in Appendix 11G. No changes to the GSP text were made.]* **Please note the following best practices for depth to groundwater contour maps:**
    - Are the wells used for interpolating depth to groundwater sufficiently close (<5km) to NC Dataset polygons to reflect local conditions relevant to ecosystems?
    - Are the wells used for interpolating depth to groundwater screened within the surficial unconfined aquifer and capable of measuring the true water table (see comment b above)?
    - Is depth to groundwater contoured using groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape? This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is

[5] Available at: https://catalog.data.gov/dataset/usgs-national-elevation-dataset-ned-1-meter-downloadable-data-collection-from-the-national-map-

constant, which is a poor assumption to make. It is better to assume that water surface elevations are constant in between wells, and then calculate depth to groundwater using a DEM of the land surface to contour depth to groundwater.

- *[The GSA's response states: "The methodology is described in Appendix 4A. Only areas south of Chular or near the coast have groundwater elevations within 30 feet of ground surface." We stand by the methodology in the GDE Guidance Document. This response does not address our comment and no changes to the GSP text were made.]* **Please clarify how the light blue shaded area shown in Figure 4A-3 (depth to water < 30 ft south of Chualar) is used for the GDE analysis. The figure implies an incorrect interpretation of the GDE Guidance.** Were GDEs in the Subbasin identified only in the overlap of areas south of Chualar *and* areas with depth to water < 30 ft? As the GSP states correctly (Appendix 4A p. 3), if any of the three criteria from the GDE Guidance Document are true, then you likely have a GDE. The figure implies that potential GDEs were only identified in the Quaternary Alluvium south of Chualar, disregarding potential GDEs in the rest of the Subbasin (in other words, the figure implies that GDEs were identified in areas where Criteria 1 AND 2 hold true, not where Criteria 1 OR 2 hold true). This is an incorrect interpretation of the GDE Guidance. As stated above, if any of the three criteria from the GDE Guidance Document are true, then you likely have a GDE.
- *[The GSA's response states: "Comment noted." No changes to the GSP text were made.]* **Please use care when considering rooting depths of vegetation. Please list the species in each GDE, and whether the GDE was eliminated or retained based on the 30-foot standard, and provide evidence for the decision.** While Valley Oak (Quercus lobata) have been observed to have a max rooting depth of ~24 feet (https://groundwaterresourcehub.org/gde-tools/gde-rooting-depths-database-for-gdes/), rooting depths are likely to spatially vary based on the local hydrologic conditions available to the plant. Also, max rooting depths do not take capillary action into consideration, which will vary with soil type and is an important consideration since woody phreatophytes generally do not prefer to have their roots submerged in groundwater for extended periods of time, and hence can access groundwater at deeper depths.
- *[The GSA's response states: "Our ability to identify areas of interconnected surface water will be improved when the SVIHM becomes available." For clarity, please elaborate on this statement in the GSP text.]* While depth to groundwater levels within 30 feet are generally accepted as being a proxy for confirming that polygons in the NC dataset are connected to groundwater, it is highly advised that seasonal and interannual groundwater fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one point in time (e.g., Fall 2013) can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Based on a study we recently submitted to Frontiers in Environmental Science Journal, we've observed riparian forests along the Cosumnes River to experience a range in groundwater levels between 1.5 and 75 feet over seasonal and interannual timescales. Seasonal fluctuations in the regional water table can support perched groundwater near an intermittent river that seasonally runs dry due to large seasonal fluctuations in the regional water table.

While perched groundwater itself cannot directly be managed due to its position in the vadose zone, the water table position within the regional aquifer (via pumping rate restrictions, restricted pumping at certain depths, restricted pumping around GDEs, well density rules) and its interactions with surface water (e.g., timing and duration) can be managed to prevent adverse impacts to ecosystems due to changes in groundwater quality and quantity under SGMA. **We highly recommend using depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP *until* data gaps are reconciled in the monitoring network.**

- *[The GSA's response states: "Interim maps are included in Appendix 4A. Figure 4-10 is intended to only show the final set of potential GDEs." The Draft Figure 4-10 shows a small subset of the NC dataset, however Figure 4-10 in the Final GSP appears to show the entire NC dataset. If this is indeed the intended map of potential GDEs, then TNC applauds the GSA's decision to retain all of the NC dataset as potential GDEs. Please address the apparent inconsistency between Figure 4-10 and Appendix 4A.]* Decisions to remove, keep, or add polygons from the NC dataset into a basin GDE map should be based on best available science in a manner that promotes transparency and accountability with stakeholders. Any polygons that are removed, added, or kept should be inventoried in the submitted shapefile to DWR, and mapped in the plan. **We recommend revising Figure 4-10 to reflect this change.**

Checklist Items 16 to 20, Describing GDEs (23 CCR §354.16)

[4.4.4 Natural Discharge Areas (p. 4-23)]
[Appendix 4A Methodology for Identifying Potential Groundwater Dependent Ecosystems]

- *[The GSA's response states: "This will be undertaken should the GSA opt to undertake additional GDE analysis." For clarity, please elaborate on this statement in the GSP text.]* Not all GDEs are created equal. Some GDEs may contain legally protected species or ecologically rich communities, whereas other GDEs may be highly degraded with little conservation value. Identifying an ecological value of each GDE can help prioritize limited resources when considering GDEs as well as prioritizing legally protected species or habitat that may need special consideration when setting sustainable management criteria. **Please include a description of the types of species (protected status, native versus non-native), habitat, and environmental beneficial uses (see Worksheet 2, p.74 of GDE Guidance Document) and assign an ecological value to the GDEs.**
- *[The GSA's response states: "This has been identified as a data gap that will be addressed during implementation." Thank you for recognizing this important data*

gap.] **Are any of the wells from the MCWRA program (described in Section 5.1.1 of the Salinas Valley Basin ISP) close enough (<1 km) to GDEs and screened in the shallow portions of the aquifer to characterize historical and current groundwater conditions for each GDE? If data gaps exist, they should be discussed in Chapter 5.**

- *[The GSA's response states: "Comment noted." No changes to the GSP text were made and our comment was not addressed.]* The GDE Pulse web application developed by The Nature Conservancy provides easy access to 35 years of satellite data to view trends of vegetation metrics, groundwater depth (where available), and precipitation data. This satellite imagery can be used to observe trends for NC dataset polygons within the 180-400 Foot Aquifer area (Figure 1). Over the past 10 years (2009-2018), NC dataset vegetation polygons have experienced adverse impacts to vegetation growth and moisture which are correlated to declines in groundwater levels (e.g., as indicated by wells GZWA21202, CHEA21208).

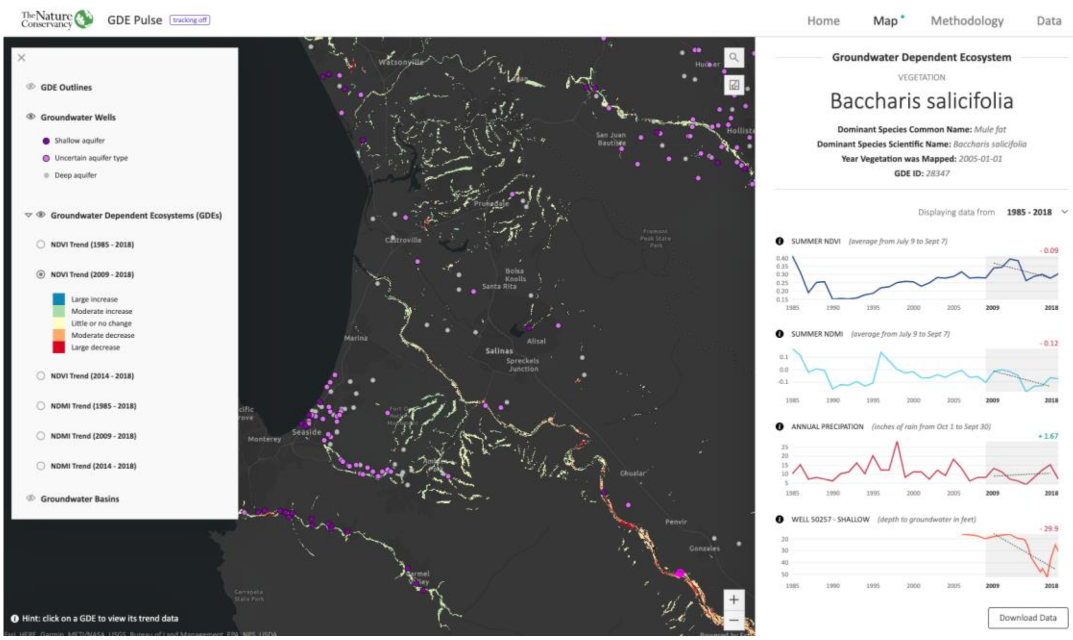


Figure 1. GDE Pulse web viewer screenshots of satellite-based trends of vegetation growth (NDVI), moisture (NDMI), shallow groundwater levels, and precipitation for selected vegetation from the NC dataset in the 180-400 Foot Aquifer area.

Checklist Items 23 to 25 – Sustainability Goal (23 CCR §354.24)

[Section 8.2 Sustainability Goal (p. 8-3)]

- *[The GSA's response states: "In accordance with the SGMA regulations, the GSP currently describes the assessment of whether surface water depletions are significant and unreasonable." This response does not address our comment and no changes to the GSP text were made.]* **In a future draft of the document, please provide more details on how the needs of environmental beneficial users (GDE and ISW ecosystems) will be balanced with other water users in the**

basin. The sustainability goal should describe how projects and actions will balance environmental water needs and avoid adverse impacts to GDEs and ISWs, how the basin will be operated to maintain or improve these aquatic ecosystems, and an explanation of how the sustainability goal will be achieved within 20 years of implementation of the GSP. For more case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

[Section 8.3 General Process for Establishing Sustainable Management Criteria (p. 8-5)]

- *[The GSA's response states: "All cited material will be uploaded to the SGMA Portal when the GSP is uploaded. Environmental stakeholder engagement is addressed in Chapter 11." For clarity please cross reference this information in this section of the GSP.]* This section broadly lists how the chapter was developed, but "publicly available information" and specific stakeholders are not clearly defined or cross referenced to other sections. **Please provide or cross-reference this information, including reference to publicly available information regarding GDEs that was researched and how environmental stakeholders were engaged.**

Checklist Item 26 – Measurable Objectives (23 CCR §354.30), and Checklist Items 27-29 – Minimum Thresholds (23 CCR §354.28)

[Section 8.11 Depletion of Interconnected Surface Water SMC (p. 8-56)]

- This section states that …"*shallow sediments above the confined 180-Foot aquifer … are connected to the surface water system. However, there almost no groundwater pumping in this area and it is not identified as a defined aquifer. The Salinas River tends to be a losing river where surface water infiltrates into the unconfined zone above the 180-Foot Aquifer. This occurs primarily in the dry season, and the Salinas River is largely dependent on the San Antonio and Nacimiento Reservoir releases for its continuous flow rate.*" Groundwater extraction from the 180-400 Foot Aquifer System has the potential to locally affect conditions in the overlying Shallow Aquifer and deplete interconnected surface water, potentially causing adverse impacts to the environmental beneficial users in the basin. **Please integrate the following information into this section of the GSP to appropriately establish SMC for ISWs in a way that achieves the basin's sustainability goal to balance *all* beneficial users of the basin:**
    - *[The GSA's response states: "Comment noted. In accordance with DWR Bulletin 11, The GSP does not identify the shallow sediments as a principal aquifer." We disagree with this assertion and no changes to the GSP text were made.]* **The shallow aquifer is indeed a principal aquifer that needs SMC established to prevent adverse impacts to surface water beneficial users.** SGMA defines principal aquifers as "aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, **springs, or surface water systems"** [23 CCR § 351 (aa)]. In addition, more nested/clustered wells are needed in the 180-400

Foot Aquifer area to determine vertical groundwater gradients and whether pumping in the deeper aquifers are causing groundwater levels to lower in the shallow aquifer and deplete surface water.

- *[The GSA's response states: "The sustainable management criteria state that there will not be any increased depletion of surface water from the Salinas River due to pumping from the 180 for 400-Foot aquifers." This response does not address our comment. We disagree with this assertion and no changes to the GSP text were made.]* As previously mentioned in our April 11 letter regarding Chapter 5 of the Draft GSP, the shallow aquifer in the 180/400 Foot Aquifer and Monterey Subbasins are likely to be supporting GDEs and interconnecting with the Salinas River. Thus, pumping in *deeper aquifers* can still cause adverse impacts to environmental beneficial users reliant on shallow groundwater. Even if pumping is not occurring in shallow groundwater aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, especially those that support springs, surface water and GDEs for current and future uses.
- *[The GSA's response states: "The GSP notes that the Salinas Valley Aquitard is thin or absent in places. However the depth to groundwater map shown on Figure 5-35 shows that groundwater elevations in the 180-Foot aquifer are high enough to be hydraulically connected to the Salinas River in only limited areas." We have detailed our methodology and disagree with this assertion. This response does not address our comment and no changes to the GSP text were made.]* Several published references indicate that the 180-Foot aquifer is in direct hydraulic communication with the overlying Dune Sand Aquifer or Shallow Alluvial Aquifer where the Salinas Valley Aquitard is thin or absent.[6] These same references indicate aquitards within the 180/400 Foot aquifer system are known to be locally discontinuous. In addition, the fact that the Salinas is a losing stream and that 67,000 acre feet are recharged from the stream to the groundwater basin in an average year strongly suggests that the shallow aquifer is hydraulically connected to the underlying pumped aquifer systems.

[Section 8.11.2 Minimum Thresholds; Section 8.11.1 Locally Defined Significant and Unreasonable Conditions; and 8.11.2.1 Information and Methodology for Establishing Depletion of Interconnected Surface Minimum Thresholds (p. 8-51 to 8-58)]

- *[The GSA's response states: "Chapter 8 includes a discussion of how minimum thresholds effect ecological users for each of the six sustainability indicators." This response does not address our comment and no changes to the GSP text were made.]* These sections explain that the definition of Significant and Unreasonable Conditions, and establishment of Minimum Thresholds and Measurable Objectives is based on considerations related to flows in the Salinas River and specifically the maintenance of minimum flows for the protection of aquatic species and water

[6] See for example "Interpretation of Hydrostratigraphy and Water Quality from AEM Data Collected in the Northern Salinas Valley, CA," by Knight et al., dated 15 March 2018, and Recommendations to Address the Expansion of Seawater Intrusion in the Salinas Valley Groundwater Basin, Special Reports Series 17-01," by Monterey County Water Resources Agency, dated October 2017.

rights. Steelhead are not the only environmental user that need consideration. A list of freshwater aquatic species identified in the 180-/400-Foot Aquifer Subbasin is included for your reference as Attachment C. It appears that GDEs have been omitted, as they are not mentioned or considered. We believe this to be a deficiency, as the Department of Water Resource's NC Dataset Viewer indicates a variety of potential GDE habitats are located in the subbasin along the Salinas River and its tributaries, and not just within the stream. Furthermore, TNC's GDE Pulse Tool (Attachment E) shows declining ecosystem conditions along the Salinas River between 2014 and 2018, including the period *after* the recent drought (and *after* the baseline period specified in SGMA). NDVI (which represents vegetation growth) and NDMI (which represents vegetation moisture) coincide with a decline in groundwater levels for NC dataset polygons along the Salinas River west of Salinas (Figure 1). **Please include a discussion of how baseline conditions, current trends and potential adverse impacts to GDEs were considered in the definition of significant and unreasonable conditions and establishment of Minimum Thresholds and Measurable Objectives. A discussion of applicable state, federal and local standards, policies and guidelines applicable to the GDE species and habitats identified should also be provided. The section should explain how, in light of the nature and condition of the GDEs, these Sustainable Management Criteria will prevent undesirable results related to damage to GDE resources. Any data gaps and the means to address them should be identified.**

[Section 8.11.2.4 Effects on Beneficial Uses and Users (p. 8-62)]

- *[The GSA's response states: "The GSP addresses GDEs as required by regulation. The Board of Directors was informed during open session that they have the ability to expand the definition of significant and unreasonable groundwater elevations to address GDEs." We stand by our reasoning and disagree with this assertion. This response does not address our comment and no changes to the GSP text were made.]* The listing of beneficial uses of interconnected surface water is limited to instream resources of the Salinas River alone. **Please expand the listing of beneficial uses and users to address GDEs and ecosystems that are located adjacent to the river and its tributaries.** A list of fresh water aquatic species identified in the 180-/400-Foot Aquifer Subbasin is included for your reference as Attachment C. The relationships between GDEs and ecosystems adjacent to the river and its tributaries, and their dependence on interactions with ISW and groundwater, are key to understanding the appropriateness of the subbasin-wide Minimum Threshold for interconnected surface water depletion being proposed for all ISWs. GDEs adjacent to the river should also be considered when establishing the SMC for Chronic Lowering of Groundwater levels. Adjacent or nearby GDEs could be significantly affected by small depletions depending on the depletion rate, their location and the existing surface and groundwater hydraulic gradients. However, even if they are not, these GDEs could still be affected by relatively modest groundwater level declines and likely still need to be considered separately according to groundwater levels under the Chronic Lowering of Groundwater SMC. **The discussion of ecological land uses and users should include GDEs and**

ecosystems adjacent to the river and its tributaries, and their dependence on interactions with ISW and groundwater.

[Section 8.11.2.5 Relation to State, Federal, or Local Standards (p. 8-63)]

- *[The GSA's response states: "As discussed in Section 8.11.1, The U.S. Army Corps of Engineers has re-initiated consultation with the National Marine Fisheries Service on the Biological Opinion. No flow requirements are presently in place, even though MCWRA continues to operate in accordance with the 2007 biological opinion as a safe harbor practice. The GSP is not required to meet flow requirements, it is only required to assess whether depletions due to pumping are significant and unreasonable. Therefore, there is no need to list flow requirements in this document. The Salinas Valley Water Project Flow Prescription for Steelhead Trout in the Salinas River (MCWRA, 2005) will be included in the list of references uploaded to DWR during GSP submission." Thank you for discussing the NMFS flow requirements. Please address the remainder of our comment in the GSP.]* **We recommend the streamflow requirements set by the NMFS should be explicitly stated or referenced in the GSP. In addition, any other state, federal or local standards, requirements and guidelines pertaining to the GDE habitats and species identified in the NC dataset or the list of species included in Attachment C should also be discussed or referenced.**

[Section 8.11.2.6 Method for Quantitative Measurement of Minimum Threshold (p. 8-63)]

- *[The GSA's response states: "The GSP will be addressed regularly in accordance with SGMA regulations. The modeling approach to assessing depletions due to pumping is the approach proposed in the DWR BMP for monitoring." Please further discuss in the GSP how modeling results will be used to avoid undesirable results to environmental beneficial users.]* Modeling/calculation of surface water depletion is the only proposed means to measure the minimum threshold for depletion of ISWs. Ecosystems sensitive to declines in groundwater levels and depletion of interconnected surface waters can experience significant declines in a short period of time depending on their hydraulic function, structure and the species involved. Use of a single calculated value in lieu of measured field data and linkages to other measured hydrogeologic data (such as groundwater levels) leaves a significant data gap that must be filled to assure protection of these resources**. Model estimates should be monitored more closely than every five years in order to detect potentially significant effects in a time frame that allows for rapid response and alleviation of ecosystem decline.** As discussed, the TNC's GDE Pulse Tool (Attachment E) already shows declining ecosystem conditions along the Salinas River between 2014 and 2018, including the period _after_ the recent drought (and _after_ the baseline period specified in the SGMA). **Please discuss how the minimum threshold will be measured in a way that assures protection of GDEs and instream environmental beneficial users.**

[Section 8.6.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives (p. 8-8 to 8-16)]

- *[The GSA's response states: "No wells are included for the shallow sediments because they do not constitute a principal aquifer. However, shallow wells along the Salinas River that will help estimate river depletions are identified as a data gap, and will be installed during implementation." We stand by our reasoning and disagree with this assertion. This response does not address our comment and no changes to the GSP text were made.]* This section describes the methodology used to establish Minimum Thresholds and Measurable Objectives for Chronic Groundwater Level Decline. Subbasin-wide groundwater levels experienced in 2015 are defined as the Minimum Threshold, and the Measurable Objective was established the subbasin-wide groundwater levels experienced in 1992, which were approximately 1 foot higher. Table 8-2 (p. 8-15) lists "Representative Monitoring Sites" or wells where groundwater levels will be measured and compared to the Measurable Objectives to assess compliance with the plan. **It is noteworthy that the table does not include a *single* well completed in the Shallow Alluvial or Dune Sand Aquifer. Please identify the lack of shallow aquifer monitoring wells as a data gap, and cross reference your plans discussed in Chapter 7 to install a sufficient number of shallow monitoring wells to assess potential undesirable results to GDEs.**

[Sections 8.6.2.3 Relationship between Individual Minimum Thresholds (p. 8-16 to 8-18) and Section 8.7.2.2 Relationship to Other Sustainability Indicators and (p. 8-26 to 8-27)]

- *[The GSA's response states: "In accordance with SGMA regulations, Chapter 8 includes a discussion of how minimum thresholds effect ecological users for each of the six sustainability indicators." Our interpretation of the regulation differs and we disagree with this assertion. This response does not address our comment and no changes to the GSP text were made.]* When groundwater levels are used as an objective, their relationship to other Sustainability Indicators must be discussed. These sections describe the relationship of chronic groundwater level declines and change in groundwater storage, which are measured using groundwater levels, to depletion of interconnected surface waters. The discussion is limited to the potential effect of groundwater levels on stream flows, and the potential effect of groundwater level declines on GDEs is not mentioned. The statement that *"minimum thresholds for reduction in groundwater storage is a single value for the entire Basin. Therefore, the concept of potential conflict between minimum thresholds is not applicable"* does not recognize the potential presence of ecosystems and GDEs that could be sensitive to relatively minor or localized declines in groundwater levels. The potential effect of groundwater level declines on GDEs depends on multiple conditions including the type of vegetation present and its ability to adapt to changing groundwater levels, the local interaction between surface and groundwater, and the nature of regional and local pumping stresses. Specification of a single groundwater level is likely insufficient to assure protection of GDEs in the absence of a monitoring program that encompasses both groundwater levels *and* related surface conditions (23 CCR §354.34 (a) and (b)), e.g., the health of the GDEs, for example, by using a tool similar to GDE Pulse. **Please revise these sections to include a discussion regarding the effects of potential groundwater level declines on GDEs and**

limitations of groundwater level monitoring alone to assess potential undesirable results to GDEs.

[Sections 8.6.2.5 Effects on Beneficial Users and Land Uses (p. 8-18 to 8-19) and 8.7.2.4 Effects on Beneficial Uses and Users (p. 8-28)]

- *[The GSA's response states: "In accordance with SGMA regulations, chapter 8 includes a discussion of how minimum thresholds effect ecological users for each of the six sustainability indicators." Our interpretation of the regulation differs and we disagree with this assertion. This response does not address our comment and no changes to the GSP text were made.]* The discussion on ecological land uses and users does not include a discussion on GDEs, ISWs, or other uses that benefit aquatic and terrestrial wildlife, ecosystem processes or recreation. A list of fresh water aquatic species identified in the 180-/400-Foot Aquifer Subbasin is included for your reference as Attachment C. These sections imply that ecological land uses *may* benefit secondarily from the potential curtailment of agricultural and domestic land uses, but does not clearly state how these specialized aquatic ecosystems and related beneficial groundwater users would benefit or be protected from further decline or future damage. **Please include a discussion explaining how GDEs, ISWs and recreational uses may benefit or be protected by implementation of the proposed Minimum Thresholds and Measurable Objectives.** A list of freshwater aquatic species identified in the 180-/400-Foot Aquifer Subbasin is included for your reference as Attachment C.

[Section 8.6.4.3 Effects on Beneficial Users and Land Uses (p. 8-25)]

- *[The GSA's response states: "The undesirable result includes the additional clause that no one well will exceed its minimum threshold for more than two consecutive years to avoid ongoing, localized water level declines." This response does not address our comment regarding the use of GDE Pulse data and no changes to the GSP text were made.]* This section discusses the effects on beneficial users and land uses of criteria used to define undesirable results related to chronic groundwater level decline. Fifteen percent of exceedances is considered reasonable if the wells are widespread through the subbasin. The section acknowledges that significant unreasonable effects could occur in a smaller clustered area due to localized pumping, but does not describe specifically how the proposed regional compliance strategy will identify or address a more localized occurrence. TNC's GDE Pulse Tool (Attachment E) shows declining ecosystem conditions along the Salinas River west of Salinas between 2014 and 2018. **This section should be revised to use these data as a basis for addressing how the proposed compliance strategy will address significant and undesirable decline of GDEs at the spatial scale already observed in the GDE Pulse data.**

<u>Checklist Item 47-49 – Monitoring Network (23 CCR §352.34)</u>

[Table 7.2 Existing 180/400-Foot Aquifer CASGEM Well Network (p. 7-4)]

- *[The GSA's response states: "Section 7.2.4 only addresses the groundwater level monitoring plan for principal aquifers, and therefore is not relevant as a cross reference for the shallow sediments. Shallow wells along the Salinas River that will help estimate river depletions are identified as a data gap for the surface water depletion SMC." This response does not address our comment and no changes to the GSP text were made.]* The wells listed in the table and proposed for monitoring do not include <u>any</u> wells completed in the Shallow Alluvial or Dune Sand Aquifers. As such, the proposed monitoring well network is inadequate to assess the potential effects of groundwater pumping and management on ISWs and GDEs. **This fact should be acknowledged with a cross reference to Section 7.2.4 which should describe the proposed actions to remedy this situation.**

[Section 7.7 Interconnected Surface Water Monitoring Network (p. 7-24)]

- *[The GSA's response states: "Text has been added to discuss the uncertainty regarding the fate of surface water depletions." However, this response does not fully address our comment.]* This section states that *"… there is little to no interconnection between the 180-Foot, 400-Foot or Deep Aquifer and surface water in the 180/400-Foot Aquifer Subbasin."* However, the section further states that "the Salinas River is potentially in connection with groundwater in the shallow water bearing sediments" and Section 8.11.2 states that the average annual surface water depletion of the Salinas River is 67,000 acre feet. The GSP should explain how this amount of recharge can be redistributed through the aquifer system without any significant interconnection between the shallow and deeper aquifer systems. Furthermore, it is our understanding that the rate of surface water depletion from the Salinas River is in fact correlated historical groundwater level declines in the shallow and 180-Foot aquifer systems which have also resulted in seawater intrusion into the subbasin. The installation of two groundwater monitoring wells is insufficient to characterize surface-groundwater interactions across the entire subbasin. The BMP cited in section 7.2 instructs GSAs to "*Monitor surface water and groundwater … to characterize the spatial and temporal exchanges between surface water and groundwater, and to calibrate and apply the tools and methods necessary to calculate depletions of surface water caused by groundwater extractions."* Per the BMP, 13 to 14 monitoring wells would be more adequate to achieve this objective. **Please revise this section to (1) reflect what is known and published regarding potential surface-groundwater interactions in the subbasin and related groundwater level and budget trends, (2) identify the existing data gaps, and (3) provide recommendations for an adequate number of monitoring wells to assess surface-groundwater interaction and shallow groundwater level trends.**
- *[The GSA's response states: "The groundwater model will be used to assess whether future surface water depletions exceed current rates, and therefore become unreasonable." This response does not address our comment because it does not specify how <u>monitoring</u> can help determine whether impacts to GDEs are occurring. The modeling to be performed on a 5-year cycle lacks triggers to avoid undesirable results which leaves ecosystems vulnerable to decline. No changes to the GSP text were made.]* The GSP Regulations (23 CCR §354.34 (a) and (b)) require that

monitoring must address trends in groundwater _and related surface conditions_ (emphasis added). This includes "the tools and methods necessary to calculate depletions" and "[o]ther factors that may be necessary to identify adverse impacts on beneficial uses of the surface water," including impacts to GDEs. **Please specify what other monitoring data and methods will be implemented to inform a determination whether significant and unreasonable impacts to GDEs are occurring, and explain how they will adequately meet the requirements of 23 CCR §354.34(c)(6) relative to GDEs and ISWs.**

[Appendix 7B Monitoring Procedures]

- *[The GSA's response states: "Because there is no specific GDE monitoring other than estimating surface water depletion rates, no monitoring protocols are required." This response does not address our comment and no changes to the GSP text were made.]* **In Appendix 7B, please include monitoring protocols that meet the requirements of 23 CCR §354.34(c)(6) relative to GDEs and ISWs.**

<u>Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)</u>

[Section 9.1 Introduction (p. 9-1)]

- *[The GSA's response states: "The SVBGSA will attempt to address multiple benefits as the list of projects are refined." Thank you for recognizing the importance of addressing multiple benefits. Please describe multiple benefits including those to environmental beneficial users in the GSP.]* The 180/400-Foot Aquifer Subbasin includes GDEs and ISWs that are beneficial uses and users of groundwater and may include potentially sensitive resources and protected lands. Environmental beneficial users and uses should be considered in establishing project priorities. In addition, consistent with existing grant and funding guidelines for SGMA-related work, consideration should be given to multi-benefit projects that can address water quantity as well as providing environmental benefits or benefits to disadvantaged communities. **Please include environmental benefits and multiple benefits as criteria for assessing project priorities.**

[Section 9.3 Management Actions (p. 9-10 to 9-22)]

- *[The GSA's response states: "Text has been added to the existing education and outreach management action." Thank you for acknowledging the importance of education and outreach for protection of GDEs and ISWs.]* The 180/400-Foot Aquifer Subbasin GSP lists all Management Actions considered for the Subbasin in Appenidix 9A. **Please consider adding Management Actions which include education and outreach for protection of GDEs and ISWs as well as specific management of these ecosystems and the species they provide for.**

[Section 9.4 Projects (p. 9-22 to 9-86)]

- *[The GSA's response states: "The comment is inaccurate: priority projects 7, 8 and 9 are all direct recharge projects. Alternate project 2 is included only for Valley-wide* *completeness, but does not directly impact the 180/400-Foot Aquifer Subbasin. This project will be discussed in more detail in the Eastside Subbasin GSP." Thank you for clarifying this. Please further explain in the GSP text how GDEs and ISWs will benefit from these projects.]* Section 9.4.1 lists "Direct Recharge through recharge basins or wells" as one of the four major types of projects that can be developed to supplement the 180/400-Foot Aquifer Subbasin's groundwater supplies or limit seawater intrusion. However, only one of this project type is presented, as an Alternative Project. The description of Measurable Objectives for Alternate Project 2 (Recharge Local Runoff from Eastside Range) only identifies benefits to groundwater elevation, groundwater storage, land subsidence, and groundwater quality. Because maintenance or recovery of groundwater levels or construction of recharge facilities may have potential environmental benefits, it would be advantageous to demonstrate multiple benefits from a funding and prioritization perspective. **For Alternate Project 2, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.**

- *[The GSA's response states: "Existing projects and actions, including priority and alternate projects and actions, are sufficient to avoid all undesirable results." This response does not address our comment and no changes to the GSP text were made.]* If ISWs and GDEs will not be adequately protected by the projects listed, **please include and describe additional management actions and projects targeted for protecting ISWs and GDEs.**
- *[The GSA's response states: "The SVBGSA will attempt to address multiple benefits as the list of projects are refined. The clear example is project #1 - invasive species removal." Thank you for acknowledging the importance of recognizing multiple benefits in addressing project priorities. Please further elaborate on this subject in the GSP text.]* Recharge basins, reservoirs and facilities for managed stormwater recharge projects can be designed as multi-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such multi-benefit projects and facilities have been incorporated into local Habitat Conservation Plans (HCPs) and Natural Community Conservation Plans (NCCPs), more fully recognizing the value of the habitat that they provide and the species they support. For projects that construct recharge basins, **please consider identifying if there is habitat value incorporated into the design and how the recharge basins will be managed to benefit environmental users. Grant and funding considerations for SGMA-related work may be given to multi-benefit projects that can address water quantity as well as provide environmental benefits. Therefore, please include environmental benefits and multiple benefits as criteria for assessing project priorities.**
- *[This comment was not listed in the Response to Comments provided in Appendix 11G. No changes to the GSP text were made.]* For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

Attachment C

Freshwater Species Located in the 180/400-Foot Aquifer Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the 180/400-Foot Aquifer Subbasin in the Salinas Valley. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[7]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[8] as well as on The Nature Conservancy's science website[9].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			

[7] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[8] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[9] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Histrionicus histrionicus	Harlequin Duck		Special Concern	BSSC - Second priority
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority

Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Rynchops niger	Black Skimmer			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Americorophium spp.	Americorophium spp.			
Cambaridae fam.	Cambaridae fam.			
Cyprididae fam.	Cyprididae fam.			
Gammarus spp.	Gammarus spp.			
Gnorimosphaeroma spp.	Gnorimosphaeroma spp.			
Hyalella spp.	Hyalella spp.			
Neomysis mercedis				Not on any status lists
FISH				
Eucyclogobius newberryi	Tidewater goby	Endangered	Special Concern	Vulnerable - Moyle 2013
Oncorhynchus mykiss - SCCC	South Central California coast steelhead	Threatened	Special Concern	Vulnerable - Moyle 2013
Spirinchus thaleichthys	Longfin smelt	Candidate	Threatened	Vulnerable - Moyle 2013
Catostomus occidentalis mnioltiltus	Monterey sucker			Least Concern - Moyle 2013
Cottus aleuticus	Coastrange sculpin			Least Concern - Moyle 2013
Cottus asper ssp. 1	Prickly sculpin			Least Concern - Moyle 2013
Entosphenus tridentata ssp. 1	Pacific lamprey		Special	Near-Threatened - Moyle 2013

Eucyclogobius newberryi	Tidewater goby	Endangered	Special Concern	Vulnerable - Moyle 2013
Gasterosteus aculeatus aculeatus	Coastal threespine stickleback			Least Concern - Moyle 2013
Gasterosteus aculeatus microcephalus	Inland threespine stickleback		Special	Least Concern - Moyle 2013
Lavinia exilicauda harengeus	Monterey hitch		Special	Vulnerable - Moyle 2013
Lavinia symmetricus subditus	Monterey roach		Special Concern	Near-Threatened - Moyle 2013
Oncorhynchus gorbuscha	Pink salmon		Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - SCCC	South Central California coast steelhead	Threatened	Special Concern	Vulnerable - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
Rhinichthys osculus ssp. 1	Sacramento speckled dace			Least Concern - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Ambystoma macrodactylum	Long-toed salamander			
Ambystoma macrodactylum croceum	Santa Cruz Long-toed Salamander	Endangered	Endangered	
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus boreas halophilus	California Toad			ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
Pseudacris sierra	Sierran Treefrog			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC

Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis elegans terrestris	Coast Gartersnake			Not on any status lists
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis infernalis	California Red-sided Gartersnake			Not on any status lists
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS AND OTHER INVERTEBRATES				
Abedus spp.	Abedus spp.			
Ablabesmyia spp.	Ablabesmyia spp.			
Acentrella spp.	Acentrella spp.			
Aeshna interrupta interna				
Aeshna palmata	Paddle-tailed Darner			
Aeshnidae fam.	Aeshnidae fam.			
Agabus spp.	Agabus spp.			
Ameletus spp.	Ameletus spp.			
Argia spp.	Argia spp.			
Baetidae fam.	Baetidae fam.			
Baetis spp.	Baetis spp.			
Belostomatidae fam.	Belostomatidae fam.			
Berosus spp.	Berosus spp.			
Bisancora spp.	Bisancora spp.			
Brachycentrus spp.	Brachycentrus spp.			
Brillia spp.	Brillia spp.			
Calineuria californica	Western Stone			
Callibaetis spp.	Callibaetis spp.			
Centroptilum spp.	Centroptilum spp.			
Chaetocladius spp.	Chaetocladius spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Chloroperlidae fam.	Chloroperlidae fam.			
Choroterpes spp.	Choroterpes spp.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			

Corisella decolor				Not on any status lists
Corisella spp.	Corisella spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Cryptotendipes spp.	Cryptotendipes spp.			
Cymbiodyta spp.	Cymbiodyta spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Drunella spp.	Drunella spp.			
Dytiscidae fam.	Dytiscidae fam.			
Enallagma carunculatum	Tule Bluet			
Enallagma spp.	Enallagma spp.			
Epeorus spp.	Epeorus spp.			
Ephydridae fam.	Ephydridae fam.			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Gomphidae fam.	Gomphidae fam.			
Gumaga spp.	Gumaga spp.			
Gyrinus spp.	Gyrinus spp.			
Heptageniidae fam.	Heptageniidae fam.			
Hydrophilidae fam.	Hydrophilidae fam.			
Hydroporus spp.	Hydroporus spp.			
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ischnura spp.	Ischnura spp.			
Isoperla spp.	Isoperla spp.			
Laccobius spp.	Laccobius spp.			
Laccophilus spp.	Laccophilus spp.			
Lepidostoma spp.	Lepidostoma spp.			
Leptoceridae fam.	Leptoceridae fam.			
Leucrocuta spp.	Leucrocuta spp.			
Limnophyes spp.	Limnophyes spp.			
Liodessus obscurellus				Not on any status lists
Malenka spp.	Malenka spp.			
Micropsectra spp.	Micropsectra spp.			
Microtendipes spp.	Microtendipes spp.			
Mystacides spp.	Mystacides spp.			
Nanocladius spp.	Nanocladius spp.			
Nectopsyche spp.	Nectopsyche spp.			
Ochthebius spp.	Ochthebius spp.			
Onocosmoecus spp.	Onocosmoecus spp.			
Optioservus spp.	Optioservus spp.			
Oreodytes spp.	Oreodytes spp.			
Pantala hymenaea	Spot-winged Glider			

Paracladopelma spp.	Paracladopelma spp.			
Paracymus spp.	Paracymus spp.			
Parakiefferiella spp.	Parakiefferiella spp.			
Paraleptophlebia spp.	Paraleptophlebia spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Paratendipes spp.	Paratendipes spp.			
Peltodytes spp.	Peltodytes spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Psephenus falli				Not on any status lists
Pseudosmittia spp.	Pseudosmittia spp.			
Psychodidae fam.	Psychodidae fam.			
Rhagovelia distincta				Not on any status lists
Rhagovelia spp.	Rhagovelia spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Rhionaeshna spp.	Rhionaeshna spp.			
Rhithrogena spp.	Rhithrogena spp.			
Rhyacophila spp.	Rhyacophila spp.			
Serratella spp.	Serratella spp.			
Sigara spp.	Sigara spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sperchontidae fam.	Sperchontidae fam.			
Stylurus spp.	Stylurus spp.			
Sweltsa spp.	Sweltsa spp.			
Sympetrum corruptum	Variegated Meadowhawk			
Tanytarsus spp.	Tanytarsus spp.			
Tipulidae fam.	Tipulidae fam.			
Trichocorixa calva				Not on any status lists
Trichocorixa spp.	Trichocorixa spp.			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus spp.	Tropisternus spp.			
Uvarus subtilis				Not on any status lists
Zaitzevia spp.	Zaitzevia spp.			
MAMMALS				
Lontra canadensis canadensis	North American River Otter			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Ferrissia rivularis	Creeping Ancylid			CS

Ferrissia spp.	Ferrissia spp.			
Helisoma spp.	Helisoma spp.			
Hydrobiidae fam.	Hydrobiidae fam.			
Lymnaea spp.	Lymnaea spp.			
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Planorbidae fam.	Planorbidae fam.			
Pomatiopsis spp.	Pomatiopsis spp.			
Sphaeriidae fam.	Sphaeriidae fam.			
PLANTS				
Arundo donax	NA			
Azolla filiculoides	NA			
Calochortus uniflorus	Shortstem Mariposa Lily		Special	CRPR - 4.2
Carex densa	Dense Sedge			
Carex harfordii	Harford's Sedge			
Carex obnupta	Slough Sedge			
Cotula coronopifolia	NA			
Eleocharis macrostachya	Creeping Spikerush			
Euthamia occidentalis	Western Fragrant Goldenrod			
Helenium puberulum	Rosilla			
Hypericum anagalloides	Tinker's-penny			
Jaumea carnosa	Fleshy Jaumea			
Juncus effusus pacificus				
Juncus phaeocephalus phaeocephalus	Brown-head Rush			
Juncus xiphioides	Iris-leaf Rush			
Lemna minor	Lesser Duckweed			
Lepidium oxycarpum	Sharp-pod Pepper-grass			
Limonium californicum	California Sea-lavender			
Mimulus guttatus	Common Large Monkeyflower			
Navarretia intertexta	Needleleaf Navarretia			
Oenanthe sarmentosa	Water-parsley			
Perideridia gairdneri gairdneri	Gairdner's Yampah		Special	CRPR - 4.2
Phacelia distans	NA			
Phragmites australis australis	Common Reed			
Plantago elongata elongata	Slender Plantain			
Populus trichocarpa	NA			Not on any status lists

Potentilla anserina pacifica				Not on any status lists
Psilocarphus tenellus	NA			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rumex conglomeratus	NA			
Rumex occidentalis				Not on any status lists
Rumex salicifolius salicifolius	Willow Dock			
Rumex stenophyllus	NA			
Salix babylonica	NA			
Salix exigua exigua	Narrowleaf Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Sequoia sempervirens				
Sparganium eurycarpum eurycarpum				
Stachys ajugoides	Bugle Hedge-nettle			
Stachys chamissonis chamissonis	Coast Hedge-nettle			
Stellaria littoralis	Beach Starwort		Special	CRPR - 4.2
Triglochin maritima	Common Bog Arrow-grass			
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	NA			

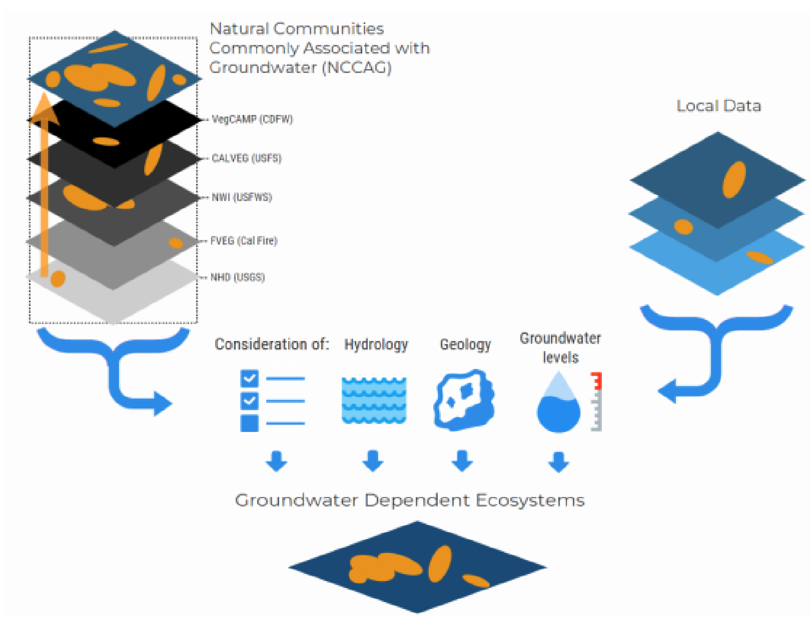
Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[10] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[11]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



The NC Dataset identifies vegetation and wetland features that are

[10] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[11] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[12]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[13] on the Groundwater Resource Hub[14], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[12] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[13] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[14] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

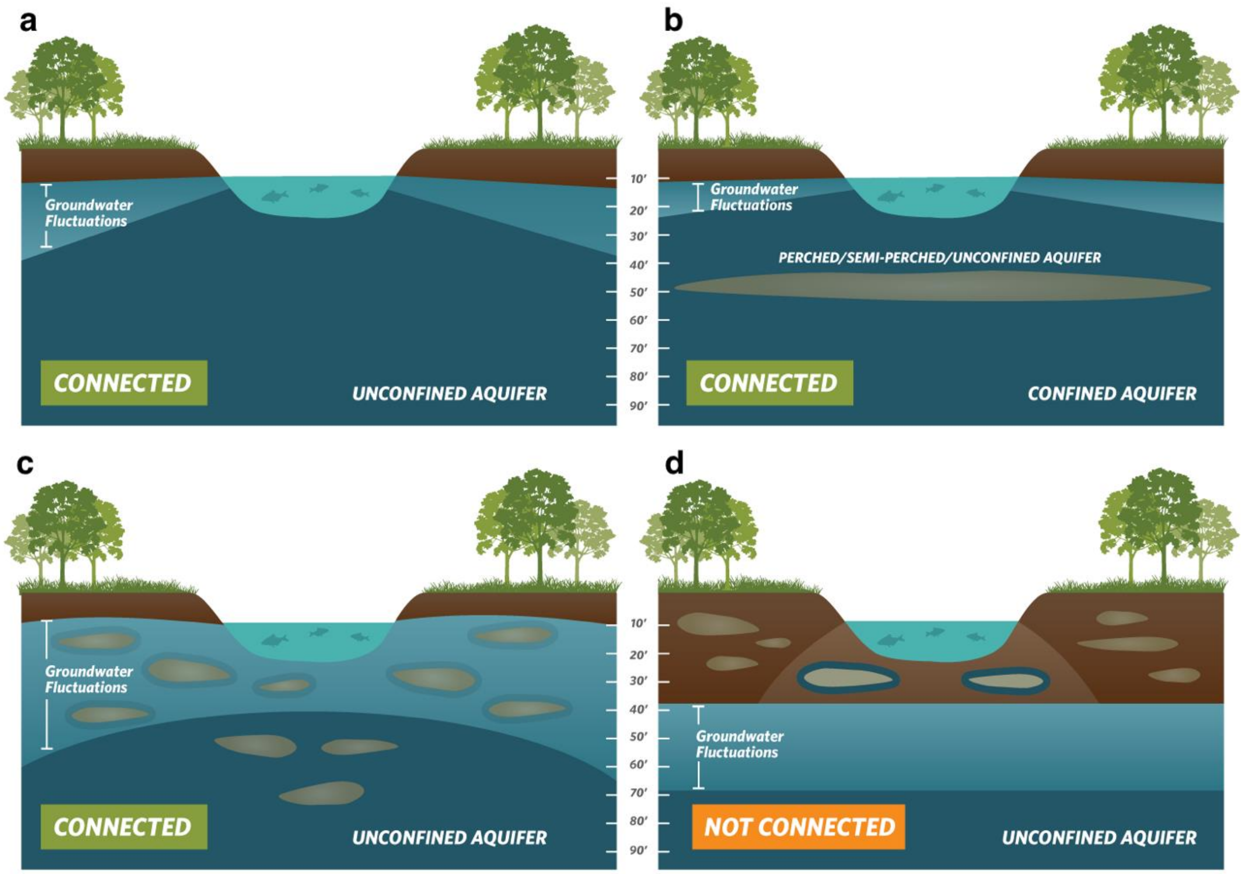


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[15] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[16] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[17] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[18]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

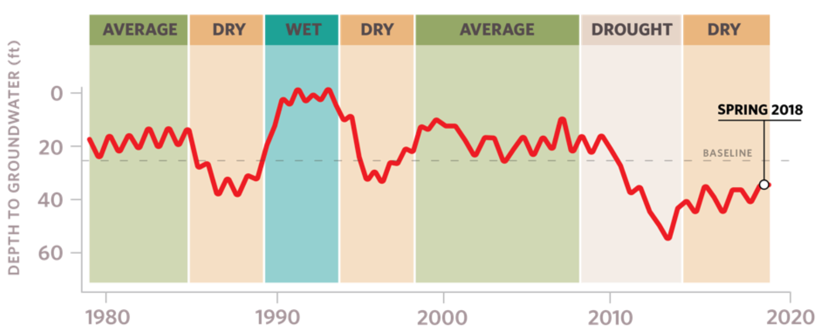


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[15] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[16] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[17] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[18] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[19], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

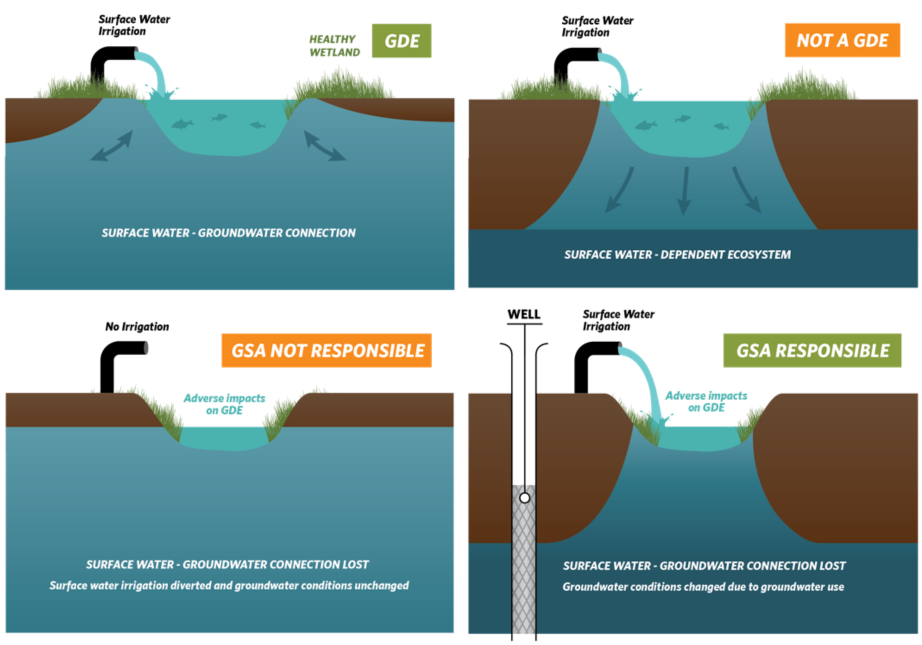

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[19] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

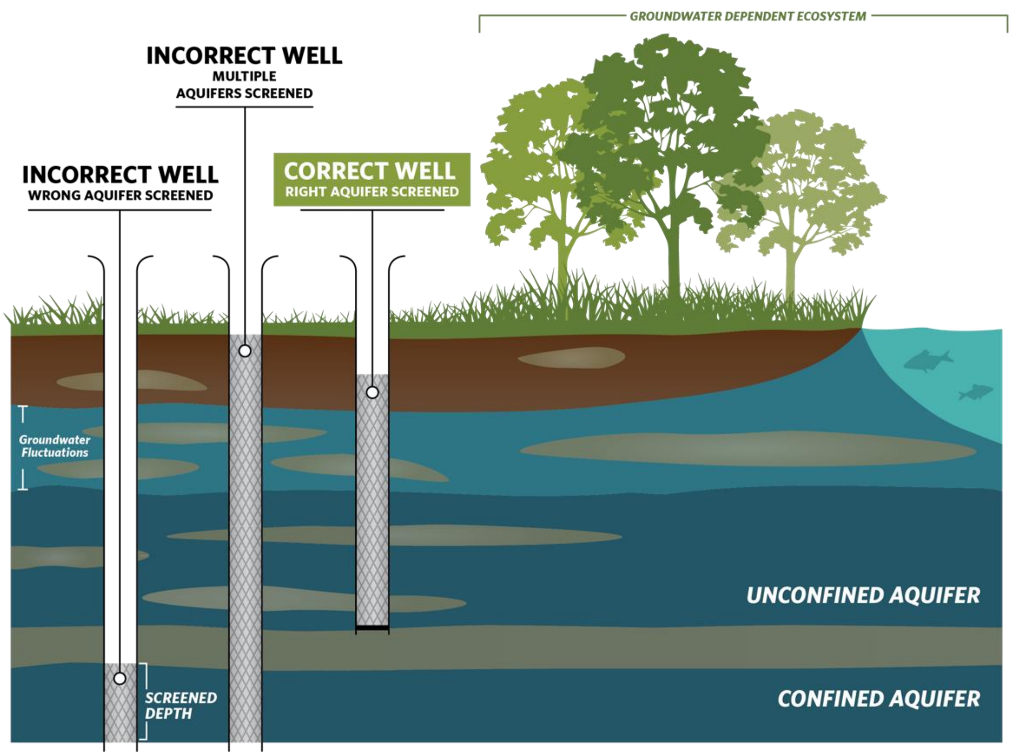

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[20] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

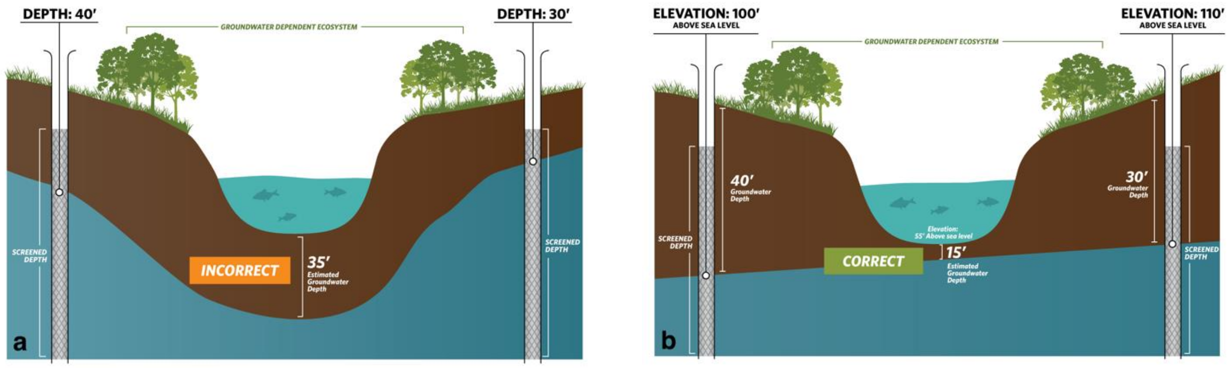

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

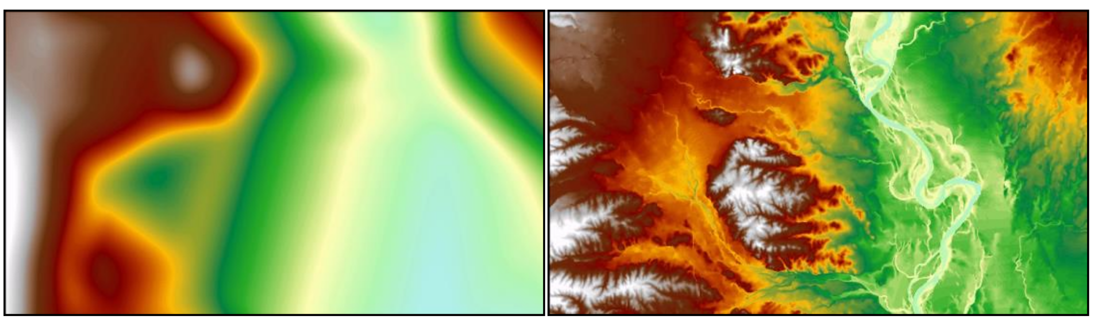

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[20] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

The Nature Conservancy
Protecting nature. Preserving life.

Visit https://gde.codefornature.org/

Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[21]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[22]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[21] *The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#*

[22] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F

The GSA Response to TNC Comments on Draft GSP is located on DWR’s SGMA portal as Part 2 of 2 of TNC’s Comments.

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[23]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[24]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[25] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[23] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[24] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[25] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: San Joaquin River Exchange Contractors Groundwater Sustainability Plan (GSP), Delta-Mendota Subbasin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the San Joaquin River Exchange Contractors Groundwater Sustainability Agency's (GSA's) Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing *sustainable* groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be insufficient in addressing environmental beneficial uses and users.

The identification of environmental beneficial users, as well as their consideration when establishing the sustainability goal, undesirable results, minimum thresholds and measurable objectives were unreasonable (23 CCR §355.4(b)(4)) and lacked best available science (23 CCR §355.4(b)(1)). In the face of existing, severe overdraft, the GSP would allow groundwater management to largely ignore potential impacts to environmental beneficial users. This could result in irreparable harm to these beneficial users, undermining the intent of SGMA to achieve sustainability.

Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address within 180 days. In these cases, we strongly recommend that the Department, at a minimum, set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update.

Should the treatment of environmental beneficial users be indicative of the quality of the overall plan, then we recommend the Department deem the plan inadequate.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment D provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment E provides a map and method summary of potential ISWs.

Our Key Considerations

Interconnected Surface Waters – The GSP took steps towards identifying ISWs by providing a narrative description of interconnected reaches of the San Joaquin River. However, quantitative analyses of these reaches were not provided. Improvements should be made to identify environmental users of surface water, gaining and losing reaches, and to account for the spatial and temporal variations in stream depletions that are inherent with California's Mediterranean climate. These components are necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). TNC recommends that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Map and Assessment of potential ISWs:
By combining multiple years and seasons of groundwater depth data, The Nature Conservancy has determined that within the SJREC GSP, 45.8 river miles are gaining, 142.4 are losing, and the rest are uncertain or likely disconnected. Attachment E contains a one-page method summary and a GSP-specific map of ISWs. The interconnected surface water displayed on the map is based on the minimum groundwater depth estimated by the California Department of Water Resources between 2011 and 2018.

Note: In most cases, the groundwater depth data used to generate the ISW map does not include perched aquifers. As such, some streams marked as disconnected could in actuality, be connected.

Groundwater Dependent Ecosystems – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 2,145 of potential GDEs occur in the GSA boundary. TNC developed the *Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs*[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

While we were pleased to see that the GSP took some steps to identify and map GDEs, we found that some GDEs were improperly disregarded. We recommend that the GSP remedy the omissions by following our recommendations in Attachment B. The GSP should also revisit all components of the plan where GDEs, as a beneficial user, must be considered, especially in determining undesirable results, minimum thresholds and measurable objectives. Our review found that NC Dataset polygons were improperly removed from the GDE map as follows:

[1] Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

- GDEs were removed on the basis of "deep water level", with no other discussion provided. More information is necessary to make a determination on the adequacy of this criterion. A defensible approach for identifying GDEs takes into account the fact that groundwater levels fluctuate over seasons and between years due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Groundwater levels temporally vary and many plant species within GDEs have adapted water stress strategies to deal with intermittent periods of deep groundwater levels.
- GDE were removed in areas adjacent to irrigated fields. However, GDEs can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields - simultaneously and at different temporal/spatial scales. Basins with a stacked series of aquifers may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow principal aquifers, that support springs, surface water, and groundwater dependent ecosystems. NC polygons adjacent to irrigated land can still potentially be reliant on shallow groundwater aquifers, thus excluding them based on their proximity to irrigated fields is incorrect.
- GDEs were removed in areas with supplemental water. The application of supplemental water to recharge areas does not preclude the possibility that NC polygons could be accessing groundwater in addition to the supplied water. GDEs can rely on multiple water sources simultaneously and at different temporal or spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow). Using this criterion disregards the presence of multiple water sources and results in GDEs being incorrectly excluded from the GSP.

<u>TNC recommendation:</u> TNC recommends that the GSA utilize groundwater levels that represent interannual and inter-seasonal variability and utilize additional information provided in Attachment C on best practices for utilizing the NC dataset to identify and consider GDEs throughout the GSP. Specifically, the GSA should use a Digital Elevation Model (DEM) when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment C. If insufficient data are available to describe groundwater conditions within or near GDEs, those GDEs should be included in the GSP until data gaps are reconciled in the monitoring network.

Water Budget – We were disappointed to see that the water budget did not include the current, historical and projected demands of native vegetation and managed wetlands, as required under SGMA (23 CCR §354.18(a) and (b)(3)). The water budget grouped evapotranspiration (ET) from phreatophytes into a miscellaneous ET term. This is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget nor will they likely be considered in project and management actions.

<u>TNC recommendation</u>: As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA

(23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

<u>TNC recommendation</u>: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. As a result, the monitoring network does not adequately characterize GDEs and other environmental beneficial users of surface water and groundwater. Potential GDEs are located in areas of the subbasin where no shallow groundwater monitoring currently exists. Potential ISWs have been identified in the GSP, however there are no recommendations provided to improve ISW identification, mapping, and estimates of depletions. Therefore, GDEs and ISWs are not being specifically addressed by the monitoring network in the GSP.

<u>TNC recommendation</u>: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess potential impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but *sustainable* groundwater management that considers the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
San Joaquin River Exchange Contractors Groundwater Sustainability Plan

The San Joaquin River Exchange Contractors Groundwater Sustainability Plan (GSP) was adopted in December 2019. This attachment summarizes our comments on the Final GSP. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

[Section 2.1.5 Notice and Communication (p. 49)]

- Beneficial uses are listed as agriculture, domestic wells, municipal wells, public water systems, environment, surface water users where there is a connection to groundwater, federal interests, DAC and industrial wells. The GSP states (p. 27): "The United States Fish & Wildlife Service owns land east of the City of Los Banos. There are several parcels of land that have a California Conservation Easement. The California Department of Fish and Wildlife own and operate lands included California Protected Areas and Wildlife Areas." **Please identify these protected lands and conservation areas and list any additional beneficial uses and users of groundwater in the subbasin, such as recreational areas and other public trust uses including aquatic habitat and fisheries.**
- The types and locations of environmental uses, species and habitats supported, instream flow requirements, and other designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the GSA should be specified. **To identify environmental users, please refer to the following:**
    - The NC Dataset (https://gis.water.ca.gov/app/NCDatasetViewer/) which identifies potential presence of groundwater dependent ecosystems.
    - The list of freshwater species located in the Delta-Mendota Subbasin listed in Appendix B of the GSP (Delta Mendota Subbasin Common Chapter). Please take particular note of the species with protected status.
    - CDFW's California Natural Diversity Database (CNDDB) - https://www.wildlife.ca.gov/Data/CNDDB
    - USFWS's IPAC report for the GSA - https://ecos.fws.gov/ipac/

Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8).

[Section 2.1.3 Land Use Elements or Topic Categories of Applicable General Plans (p. 36)]

- The GSP states (p. 36): "The SJREC GSA includes six City General Plans and four County General Plans. The SJREC GSA in coordination with other GSA's as part of the SJREC GSP group are working together to coordinate GSP development consistent with approved General Plans." **In this section, please include a discussion of General Plan goals and policies related to the protection and management of**

GDEs and aquatic resources that could be affected by groundwater withdrawals. Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of aquatic resources and other GDEs and ISWs.

- This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin and if they are associated with critical, GDE or ISW habitats. **Please identify any relevant HCPs and NCCPs within the Subbasin and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.**
- Please refer to the Critical Species Lookbook[2] to review and discuss the potential groundwater reliance of critical species in the basin. **Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.**

[Section 2.1.4 Additional GSP Elements (p. 40)]

- This section describes well permitting, well construction, and well destruction standards in each of the four countries covered by the GSA (Fresno County, Merced County, Madera County, and Stanislaus County). **Please include a discussion of how future well permitting will be coordinated with the GSP to assure achievement of the Plan's sustainability goals.**
- The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF vs. SWRCB and Siskiyou County, No. C083239). **Compliance of well permitting programs with this requirement should be stated in the GSP.**

Checklist Items 5, 6, and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

[Appendix I, Subsurface Geologic Cross Sections (p. I-30)]

- The cross sections presented in this section do not include a graphical representation of the manner in which shallow groundwater may interact with ISWs or GDEs that would allow the reader to understand this topic. **Please include an example near-surface cross section that depicts the conceptual understanding of the interaction of shallow groundwater with surface water features, as well as any potential GDEs and ISWs**.

[Appendix I, Definable Bottom of Basin (p. I-21)]

- In the SJREC GSA, the base of the usable aquifer corresponds with the base of freshwater, generally defined as groundwater with electrical conductivity of 3,000 micromhos per centimeter (Page, 1973). As noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest

[2] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** Properly defining the bottom of the basin will prevent the possibility of extractors with wells deeper than the basin boundary from claiming exemption from SGMA due to their well residing outside the vertical extent of the basin boundary.

<u>Checklist Items 8, 9, and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)</u>

[Appendix I, Interconnected Surface and Groundwater Systems in the SJREC GSA (p. I-141)]

- Appendix I (Hydrogeologic Conceptual Model and Groundwater Conditions) provides a narrative description of the interconnected reaches of the San Joaquin River in the SJREC GSA, however provides little to no quantitative estimates of seepage rates. **Please state whether seepage rates have been quantified by reach or season and present these if known. If they are unknown, identify the necessary steps, pathway and timeline to gather the needed information to inform an accurate analysis for determining the quantity and timing of streamflow depletions in the subbasin.**
- **Please note the following best practices for analysis of ISWs.** ISWs are best estimated by first determining which reaches are completely disconnected from groundwater. This approach would involve comparing groundwater elevations with a land surface Digital Elevation Model (DEM) that could identify which surface waters have groundwater consistently below surface water features, such that an unsaturated zone would separate surface water from groundwater. **Please provide or refer to depth to groundwater contour maps in this section. See Attachment C for best practices for completing this step. Specifically, ensure that the first step is contouring groundwater elevations, and the subtracting this layer from land surface elevations from a DEM to estimate depth to groundwater contours across the landscape.** This will provide much more accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. Contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make.
- This section discusses the San Joaquin River but does not discuss other surface water features in the GSA. Figure 4 (p. I-19) shows surface water bodies in the GSA which includes several creeks on the westside of the GSA. Please include a discussion of the other streams in the GSA as they represent areas of potential GDEs. **Please reconcile any data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP to improve ISW mapping in future GSPs**.

<u>Checklist Items 11 to 15, Identifying and Mapping GDEs (23 CCR §354.16)</u>

[Section 2.1.4 Additional GSP Elements (p. 46)]

- There is very little detail provided in the GSP regarding how GDEs were identified. Exclusion criteria are provided on Figures 8 and 9 (pages 47-48) but no description is provided in the text. **Please elaborate on the GDE identification process in the text, noting the following best practices to be followed when identifying GDEs.**
- **We highly recommend that depth to groundwater levels under the NC polygons be used as part of the evaluation criteria. Note the following best practices to be followed when developing depth to groundwater contours**:
    - Ensure the wells used for interpolating depth to groundwater are sufficiently close (<5km) to NC Dataset polygons to reflect local conditions relevant to ecosystems.
    - Ensure the wells used for interpolating depth to groundwater are screened within the surficial unconfined aquifer and capable of measuring the true water table.
    - Use groundwater elevations at monitoring wells to obtain groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make. It is better to assume that water surface elevations are constant in between wells, and then calculate depth to groundwater using a DEM of the land surface to contour depth to groundwater.
- It is highly advised that seasonal and interannual groundwater fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. **We highly recommend using depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. Please refer to Attachment C of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network**.
- **The actual rooting depth of vegetation growing in the area should be a consideration, and this will vary by species dominance and habitats present.** For example, some phreatophytes can root to 120-feet deep in more arid and drought-stressed environments. Furthermore, rooting depths are likely to spatially vary based on the local hydrologic conditions available to the plant. Maximum rooting depths do not take capillary action into consideration, which will vary with soil type and is an important consideration since woody phreatophytes generally do

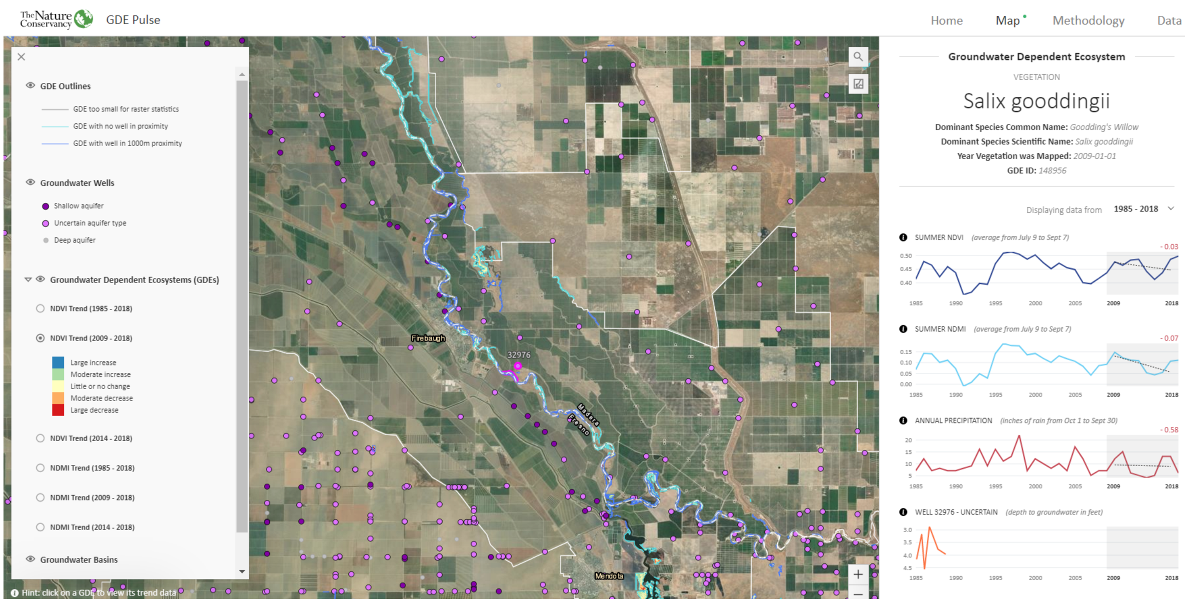
not prefer to have their roots submerged in groundwater for extended periods of time, and hence can access groundwater at deeper depths.

- The following comment applies to GDEs rejected due to being adjacent to irrigated fields. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface". **We recommend that depth to groundwater contour maps are used to identify whether a connection to groundwater exists for the NC Dataset polygons adjacent to irrigated fields. Please refer to Attachment C of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.** GDEs can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields - simultaneously and at different temporal/spatial scales. Groundwater basins can be comprised of one continuous aquifer or multiple aquifers stacked on top of each other. Basins with a stacked series of aquifers may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow principal aquifers, that support springs, surface water, and groundwater dependent ecosystems. NC polygons adjacent to irrigated land can still potentially be reliant on shallow groundwater aquifers, thus excluding them based on their proximity to irrigated fields is inadequate.
- The following comment applies to GDEs rejected due to being in areas with supplemental applied water. The application of supplemental water to recharge areas does not preclude the possibility that NC polygons could be accessing groundwater in addition to the supplied water. In the scientific literature, it is generally acknowledged that GDEs can rely on groundwater for some or all of its requirements. GDEs can rely on multiple water sources simultaneously and at different temporal/spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow). SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface." **Hence, we recommend that depth to groundwater contour maps are used to identify whether a connection to groundwater exists for the Recharge Project Areas. Please refer to Attachment C of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.**
- Figures 8 and 9 (pages 47-48) are very difficult to interpret due to the cross-hatched overlay. **In the text or on the Figures, please cite the acreage of GDEs retained and removed for each category on these figures. The basin's GDE shapefile, which is submitted via the SGMA Portal, should include two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).**

Checklist Items 16 to 20, Describing GDEs (23 CCR §354.16)

[Section 2.1.4 Additional GSP Elements (p. 46)]

- **Please provide information on the historical or current groundwater conditions in the GDEs or the ecological conditions present**. Refer to GDE Pulse (https://gde.codefornature.org; See Attachment D of this letter for more details) or any other locally available data (e.g., leaf area index, evapotranspiration or other data) to describe depth to groundwater trends in and around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in the SJREC GSA:



- **Please provide an ecological inventory (see Appendix III, Worksheet 2 of the GDE Guidance) for all potential GDEs that includes the vegetation types or habitat types and rank the GDEs as having a high, moderate or low value; and what characterizes the rank.**
- **Please identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat were found in or near any of the GDEs since some organisms rely on uplands and wetlands during different stages of their lifecycle**. Resources for this include TNC's list of freshwater species included in the Delta-Mendota Common Chapter (Appendix B of the GSP), the Critical Species Lookbook, and CDFW's CNDDB database.

Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)

[Section 2.2.3 Water Budget Information (p. 61)]

- The GSP text states (p. 61): "The ITRC-METRIC data included evaporation from canal surfaces and also ET from phreatophytes. These values have been included in the water budget under ETmisc." **In the current, historical, and projected water budgets, please separate out evapotranspiration from phreatophytes and other native vegetation, so that water needs from environmental beneficial users can explicitly be accounted for in the water budgets.**

Checklist Items 23 to 25 – Sustainability Goal (23 CCR §354.24)

[Section 3.1 Sustainability Goal (p. 96)]

- The GSP states the Sustainability Goal as (p. 96): "Sustainability Goal is defined as the existence and implementation of one or more GSP's that achieve sustainable groundwater management by identifying and causing the implementation of measures targeted to ensure that the applicable basin (or plan) is operated within its sustainable yield. Sustainable Yield is defined as managing groundwater that culminates in the absence of undesirable results by 2040." The sustainability goal does not specifically mention beneficial uses or users of groundwater, including environmental users. **Please rephrase the Sustainability Goal to specifically call out beneficial uses and users of groundwater, including environmental users. Please state how the sustainability of environmental uses will be protected.**

Checklist Item 26 – Measurable Objectives (23 CCR §354.30)

[Section 3.2.1 Measurable Objectives for Chronic Lowering of Groundwater Levels (p. 97)]

- The GSP text states (p. 97): "The measurable objective for the SJREC GSP Group is to manage to avoid shallow groundwater while maintaining groundwater levels above the minimum threshold." This sentence does not make sense; it is presumed the intended meaning or wording is "…to avoid *depleting* shallow groundwater". **Please correct the GSP text with the intended wording.**
- The description of Measurable Objectives does not explain how GDEs were considered. **Please include a discussion of GDEs in this section and explain how the Measurable Objectives will help achieve the Sustainability Goal as it pertains to the environment.**

[Section 3.2.6 Measurable Objectives for Depletions of Interconnected Surface Water (p. 98) and Section 3.3.6 Minimum Thresholds for Depletions of Interconnected Surface Water (p. 106)]

- The GSP states (p. 106): "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results. The minimum threshold established shall support the location, quantity and timing of potential depletions of interconnected surface water." The GSP states further: "The SJREC intends to work with the various counties to establish criteria consistent with the County well construction procedures, that requires the wells drilled within a certain distance of the San Joaquin River, as recommended by KDSA, to have the first encountered perforations be deep enough limit the connection with surface waters. This management technique will not only ensure that significant and unreasonable depletions of interconnected surface water are avoided but also mitigates the potential to have any direct depletion of surface water. This is consistent with maintaining the viability of those beneficial users, primarily GDE's, along the riparian corridor of the San Joaquin River." **Please elaborate on how the stated narrative on minimum thresholds protects ISWs from Undesirable Results. As required by SGMA, please set quantitative sustainable management criteria for ISWs.**

<u>Checklist Item 27-29 – Minimum Thresholds (23 CCR §354.28)</u>

[Section 3.3.1 Minimum Thresholds for Chronic Lowering of Groundwater Levels (p. 98)]

- As provided in Table 39 (p. 100), the GSP presents minimum thresholds that allow a 25% increase in depth to water beyond trigger elevations that represent three-year water level trends extrapolated to an additional drought year beyond the observed historic low. These groundwater level minimum thresholds represent groundwater elevations at representative wells continuing to decrease for the next 20 years without causing undesirable results. Adverse impacts to shallow groundwater supporting GDEs have not been considered by this methodology. Therefore, the discussion of minimum thresholds does not consider GDEs. **Please include a discussion of GDEs and whether the Minimum Thresholds will help achieve the sustainability goal as it pertains to the environment.**

<u>Checklist Item 30-46 – Undesirable Results (23 CCR §354.26)</u>

[Section 3.4.1 Undesirable Results for Chronic Lowering of Groundwater Levels (p. 108)]

- The GSP states (p. 108): "Significant and unreasonable lowering of groundwater levels in the SJREC GSP Group occurs when water levels in all of the management areas, drop below the minimum threshold shown on Table 39 and the SJREC GSP Group has extracted more than their sustainable yield of 189 TAF/year over the most recent 10 year period; described in Section 3.1.1." The use of this criteria to define an Undesirable Result does not consider GDEs. Damage to GDEs can occur within a relatively short period of time and can be irreversible, leading to a permanent loss. These criteria are insufficient to prevent undesirable results to environmental users of groundwater. **Please elaborate on how the exceedance criteria would be applied in a way that is protective of significant and unreasonable harm to GDEs.** A procedure could be included for violation of minimum thresholds that includes early identification of potential GDE impacts and appropriate response actions. This could be accomplished efficiently and cost-effectively using remote sensing tools, such as GDE Pulse.
- **Please provide more specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant**

and unreasonable impact to GDEs. The definition of 'significant and unreasonable' is a qualitative statement that is used to describe when undesirable results would occur in the basin, such that a minimum threshold can be quantified. Potential effects on all beneficial users of groundwater in the basin need to be taken into consideration. According to the California Constitution Article X, §2, water resources in California must be "put to beneficial use to the fullest extent of which they are capable". **Please identify appropriate biological indicators that can be used to monitor potential impacts to environmental beneficial users due to groundwater conditions. Refer to Attachment D of this letter for an overview of a free, new online tool for monitoring the health of GDEs over time.**

[Section 3.4.6 Undesirable Results for Depletions of Interconnected Surface Water (p. 109)]

- The GSP states (p. 109): "An undesirable result of depletions of interconnected surface water is defined as …. significant and unreasonable depletion of interconnected surface water [occurring] when groundwater extraction from the SJREC GSP Group decreases streamflow to a significant and unreasonable level for beneficial users in a stretch of the San Joaquin River that was historically losing (seeping from the river)." Because quantitative minimum thresholds were not established, the description does not identify potential effects on beneficial uses and users in the basin. **Please set quantitative sustainable management criteria for ISWs that meet SGMA standards.**
- In the quoted text in the above bullet, the SMC are only applied to 'historically losing' streams, even though both losing streams and gaining streams can be interconnected with groundwater. The defining feature of disconnected surface waters is that groundwater is consistently below surface water features such that an unsaturated zone always separates surface water from groundwater, not whether the reach is gaining or losing. **Please re-state this sentence to remove the criteria that interconnected streams must be losing streams.**

<u>Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)</u>

[Section 3.5 Monitoring Network (p. 109)]

- Figures 22 and 24 present monitoring locations for chronic lowering of groundwater levels and for depletions of interconnected surface water, respectively. The monitoring locations for shallow groundwater including along the San Joaquin River do not sufficiently characterize the shallow groundwater conditions that support GDEs. **Please detail plans to install additional shallow groundwater monitoring wells near potential GDEs in the basin and along ISWs. Please provide specific recommendations for shallow monitoring wells, stream gauges, and nested/clustered wells to inform an adequate analysis.**
- Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater *<u>and related surface conditions</u>* (emphasis added). Groundwater level monitoring alone may be insufficient to establish a linkage between groundwater extraction and potentially resulting impacts to environmental

resources associated with GDEs and ISWs. The cause-effect relationship between groundwater levels and the biological responses that could result in significant and unreasonable impacts to ISWs and GDEs depends on a number of factors, and this relationship is not characterized or discussed. **As such, it is not possible to determine whether the proposed monitoring is sufficiently protective to ensure significant and unreasonable impacts to GDEs and ISWs will be prevented. Please expand the discussion of the monitoring program to discuss how ISWs and GDEs will be protected.**

- The GSP states (p. 112): "The SJREC GSP Group does not have any data gaps that could affect the ability of the SJREC GSP to achieve sustainability." However, the Delta-Mendota Subbasin Common Chapter presented significant uncertainty for San Joaquin River Interconnectivity (Appendix B, p. B-142). **Please incorporate a discussion of data gaps in into the Monitoring Network section of the GSP.**
- **As stated above in the comments for Checklist Items 8-10, please reconcile data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells) along westside streams to improve ISW mapping in future GSPs.**

<u>Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)</u>

[Section 4.1 Projects (p. 113)]

- The GSA includes GDEs and ISWs that are beneficial uses and users of groundwater and may include potentially sensitive resources and protected lands. Protection of environmental beneficial users and uses should be considered in establishing project priorities. In addition, consistent with existing grant and funding guidelines for SGMA-related work, consideration should be given to multi-benefit projects that can address water quantity as well as providing environmental benefits or benefits to disadvantaged communities. **Please include environmental benefits and multiple benefits as criteria for assessing project priorities.**
- This section identifies multiple projects; however, the descriptions only identify benefits to water level and groundwater storage. Because maintenance or recovery of groundwater levels or construction of recharge facilities may have potential environmental benefits, it would be advantageous to demonstrate multiple benefits from a funding and prioritization perspective.
  - **For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.**
  - If ISWs will not be adequately protected by those listed, **please include and describe additional management actions and projects targeted for protecting ISWs.**
  - Recharge basins, reservoirs and facilities for managed stormwater recharge projects can be designed as multi-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such multiple-benefit projects and facilities have been incorporated into local Habitat Conservation Plans (HCPs) and Natural Community Conservation Plans (NCCPs), more fully recognizing the value of

the habitat that they provide and the species they support. For projects that construct recharge basins, **please consider identifying if there is habitat value incorporated into the design and how the recharge basins will be managed to benefit environmental users. Grant and funding priorities for SGMA-related work may be given to multi-benefit projects that can address water quantity as well as provide environmental benefits. Therefore, please include environmental benefits and multiple benefits as criteria for assessing project priorities.**

    - For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

[Section 4.2 Management Actions (p. 119)]

- The GSP lists several management actions in Section 4.2. **Please consider adding Management Actions which include education and outreach for protection of GDEs and ISWs as well as specific management of these ecosystems and the species they provide for.**

Attachment C

July 2019

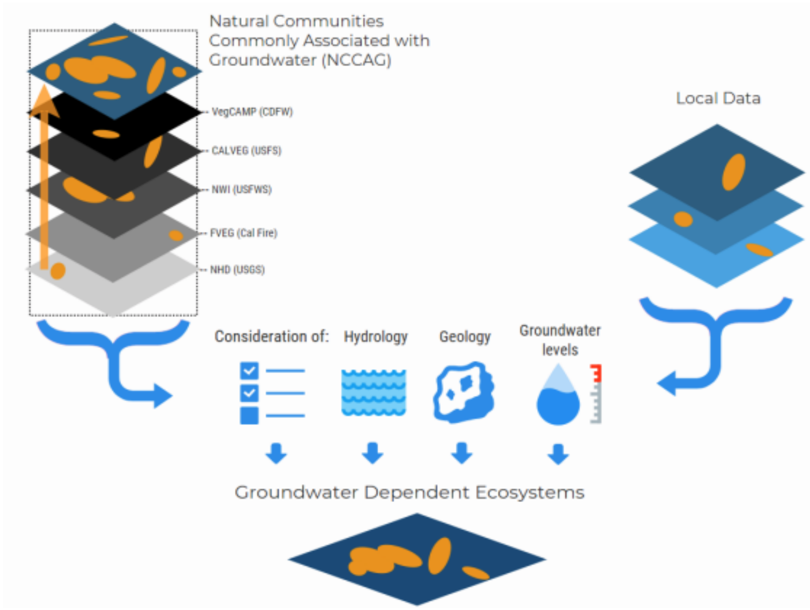
IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[3] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[4]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

[3] *NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/*

[4] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf



The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[5]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[6] on the Groundwater Resource Hub[7], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may

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[5] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[6] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[7] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

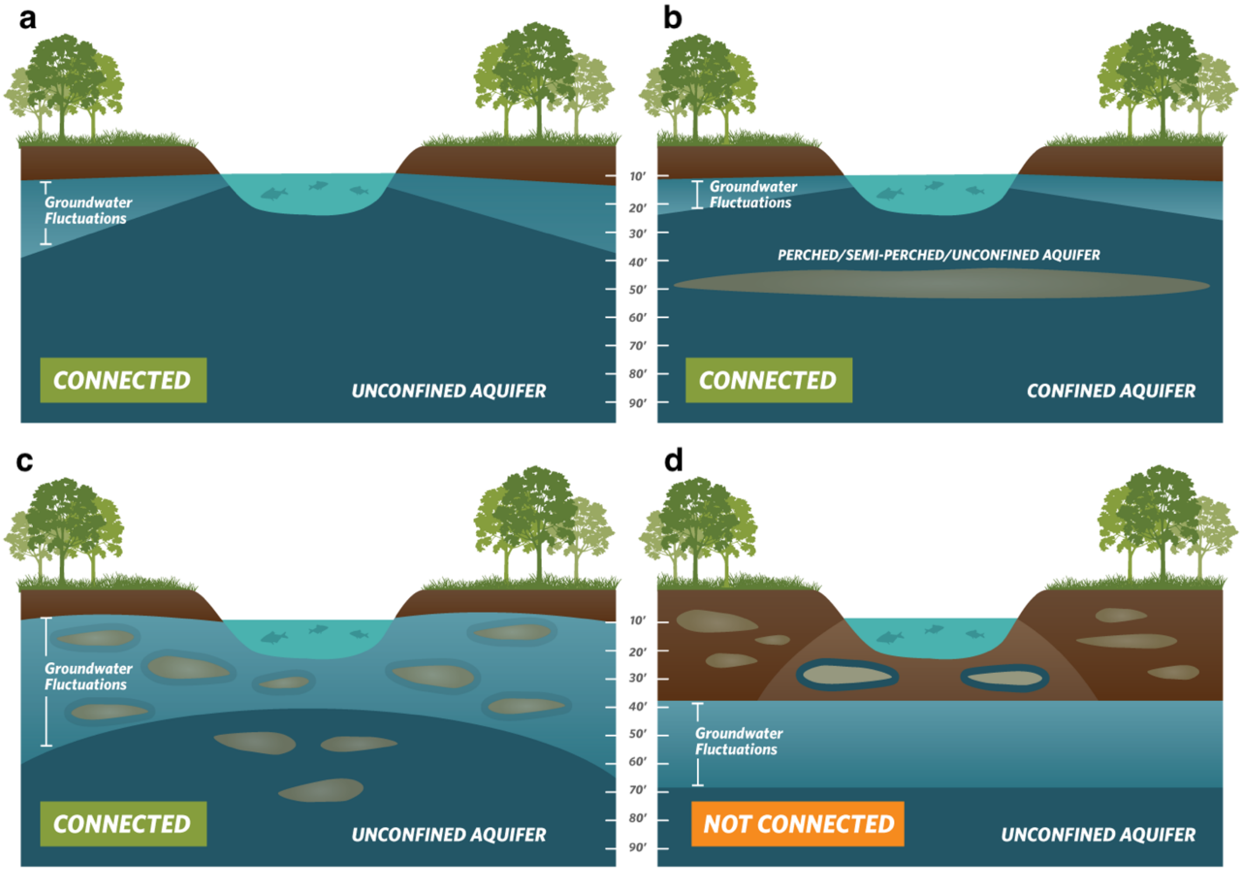

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[8] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[9] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[10] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[11]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network (see Best Practice #6).

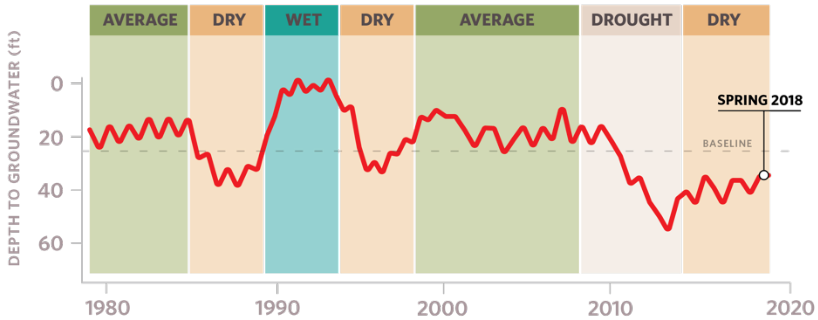

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[8] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[9] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[10] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[11] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[12], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

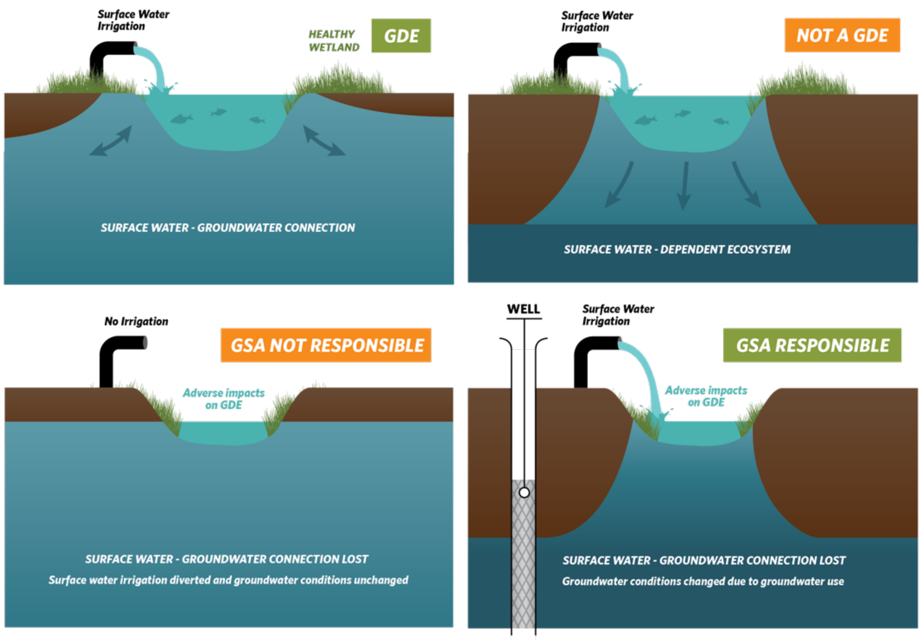

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[12] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

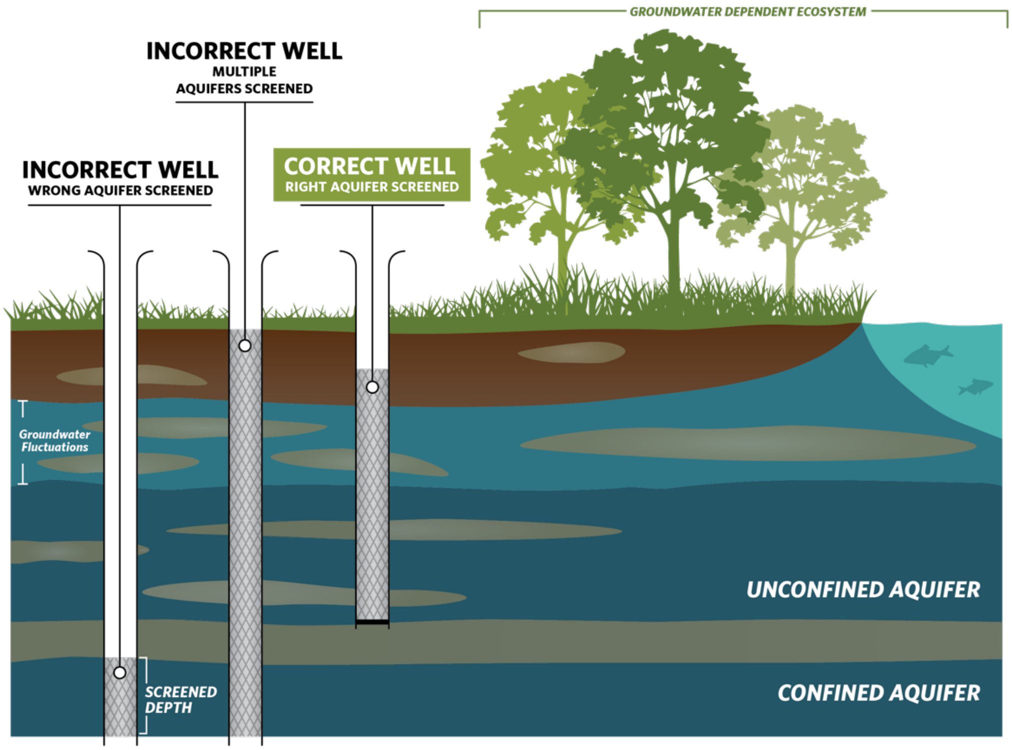

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[13] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

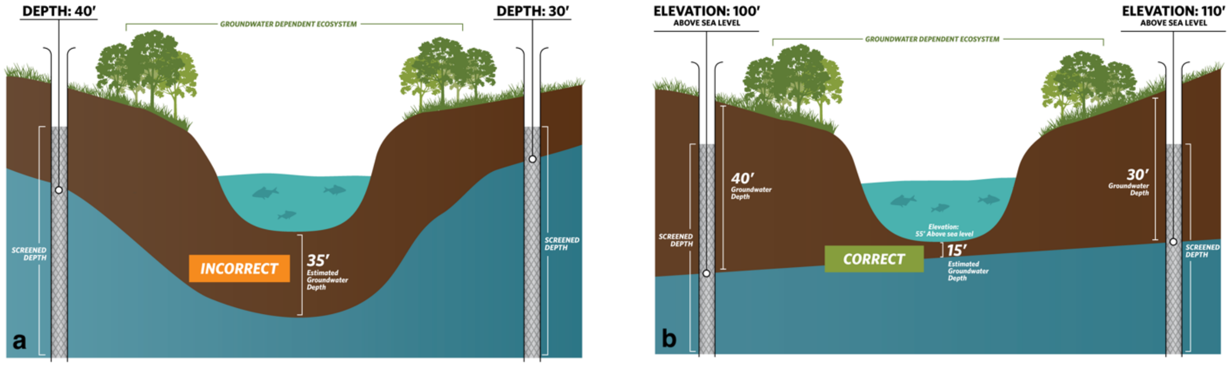

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

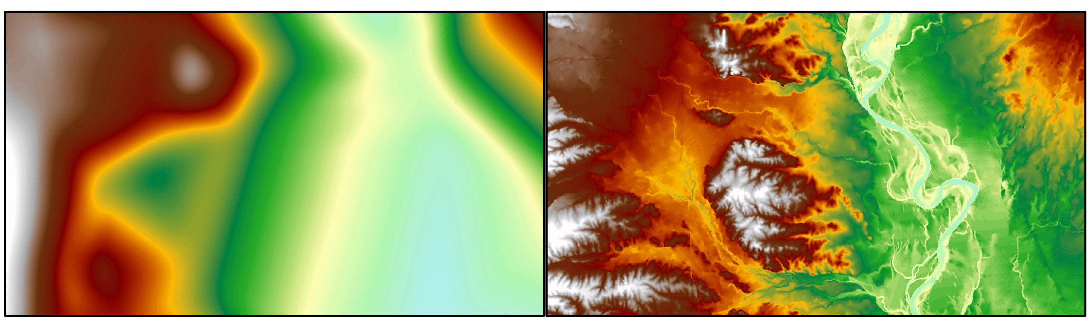

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

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[13] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment D

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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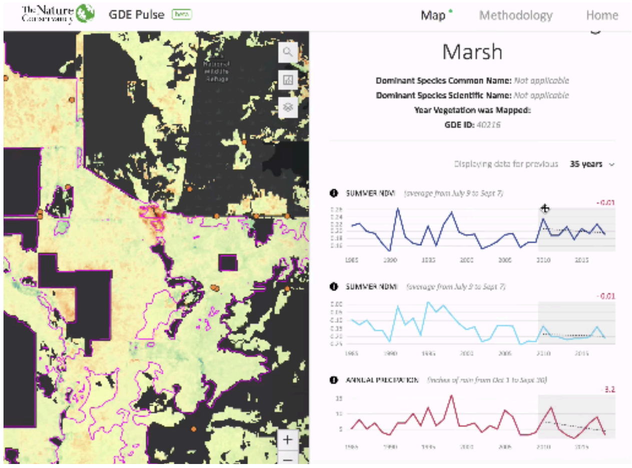
Visit
https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[14]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[15]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[14] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[15] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment E

Mapping Likely Interconnected Surface Water

The Nature Conservancy, California, May 2020

Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, ISW is defined as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:

The groundwater elevation data, available for Spring 2011-2012, and Spring and Fall 2013-2018, comes from the California Department of Water Resources (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). These data are represented as continuous raster layers that approximates "feet above or below mean sea level" based on groundwater well measurements. According to the documentation online, groundwater level measurements were selected based on measurement date and well construction information (where available) and are intended to approximate the groundwater levels in the unconfined to uppermost semi-confined aquifers. Each of the raster layer has a different extent, but all of them are limited to the Central Valley. To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

The map splits groundwater depth into four categories:

- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.
- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.

Interconnected Surface Water: Minimum Groundwater Depth (2011-2018)

San Joaquin River Exchange Contractors GSP

Legend

- Groundwater Sustainability Agency (GSA)
- Rivers and streams outside GSA
- Groundwater Elevation Monitoring Point

Minimum Groundwater Depth

- Connected - Gaining: Groundwater at or above stream surface (45.8 miles)
- Connected - Losing: Groundwater within 20 feet of stream surface (142.4 miles)
- Uncertain*: Groundwater within 20-50 feet of stream surface (60.5 miles)
- Likely Disconnected*: Groundwater greater than 50 feet below stream surface (30.2 miles)

**Streams could be connected to riparian or perched aquifers or shallow aquifers that are poorly characterized. More data are needed to confirm disconnected status.*

Data Sources:
CA Dept. of Water Resources Groundwater Elevation Data, gis.water.ca.gov/app/gicima/
NHD Plus V2 Streams, nhdplus.com/NHDPlus/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[16]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[17]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[18] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[16] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[17] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[18] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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June 3, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Santa Cruz Mid-County Groundwater Basin Groundwater Sustainability Plan

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Santa Cruz Mid-County Groundwater Basin Groundwater Sustainability Plan (GSP) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing *sustainable* groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be incomplete in addressing environmental beneficial uses and users.

While the GSP addressed environmental beneficial users in some respects, our review finds that portions of the GSP should be remedied before being approved. Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address gaps within 180 days. In these cases, we strongly recommend that the Department set clear expectations that these be corrected in the 2025 plan update, and to the degree that gaps are due to lack of data, that these data gaps be addressed to inform the 2025 update.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the basin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides the Santa Cruz Mid-County Groundwater Agency's (MGA's) response to TNC's comments on the Draft GSP.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We appreciate that the GSP incorporated a portion of our feedback (17 of 39 comments were fully addressed and 6 were partially addressed), however we disagree with the components where our feedback was ignored or dismissed. This suggests a limited degree of engagement of environmental beneficial users and could result in a definition of sustainability that is biased towards a limited set of users in the basin. In our experience, the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan," (Emergency Regulations Section 355.4(b)(10).

TNC recommendation: We recommend that the MGA prioritize stakeholder engagement through improvements to their stakeholder engagement plan, partnerships, more representative governance and funding decisions.

Interconnected Surface Waters (ISWs) – The GSP took steps towards identifying ISWs, however improvements should be made to identify environmental users of surface water, gaining and losing reaches, and/or to account for the spatial and temporal variations in stream depletions that are inherent with California's Mediterranean climate. The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted." "At any point" has both a spatial and temporal component. Even short durations of interconnection between groundwater and surface water can be crucial for surface water flow and support of wetlands. ISWs are acknowledged for many reaches in the Plan, in addition it is acknowledged that there are instream flow requirements for steelhead. TNC appreciates the discussion on instream flow and temperature needs for steelhead and the Juvenile Steelhead and Stream Habitat Monitoring Program. The GSP could be improved by providing the instream flow targets, which are currently only referenced by a link to a website. This type of information is useful in understanding how project actions may improve or impact the hydrologic and quality needs of steelhead. It is understood that in-stream flows are not equivalent to ISWs but it does provide a valuable metric for reference. As noted in Section 3.9.1.4, the understanding of ISWs is vital for the protection of riparian vegetation.

TNC recommendation: TNC recommends that the MGA update the GSP to include the instream flow schedules and an analysis of how projects and management actions will support the required flows. TNC recommends that additional effort be put toward quantifying evapotranspiration data for riparian vegetation to support streamflow modeling using modeled estimates and actual evapotranspiration measurements derived from remote sensing. TNC also recommends obtaining additional shallow groundwater level data (and possibly installing additional shallow wells) and the installation of stream gauges to obtain additional surface flow information to inform a thorough review of surface water-groundwater interconnectivity including estimation of the quantity and timing of streamflow depletions in the basin.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 5,131 acres of potential GDEs occur in the MGA boundary. TNC developed the Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs[1], which represents the best available science on how GDEs

[1] Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

TNC appreciates the documentation of potential wetland and vegetative GDEs from DWR's NC Dataset Viewer and the list of freshwater species for the Santa Cruz Mid-County Basin in the GSP. Also, it is understood that the instream flow requirements for steelhead are being used as a surrogate metric for GDE protection. However, the Plan does not provide a spatial and temporal analysis of GDEs in relation to the instream flows and there is no monitoring plan to document GDE health. In addition, the Figure 2-10 that shows the percentage of time that surface and groundwater are connected does not include a metric on the depth to groundwater. Depth to groundwater is an important evaluation metric for assessing GDEs, but shallow monitoring wells in the basin were sparse. The explanation of the analytical effort associated with the identification is not comprehensive nor does it provide assurance that all GDEs are identified.

<u>TNC recommendation</u>: TNC recommends that the MGA update the Plan to include an analysis of GDEs with respect to instream flow requirements, identify any data gaps, and include a monitoring plan to improve the understanding of GDEs and to monitor GDE health.

Water Budget – We were disappointed to see that the water budget did not include the current, historical and projected demands of native vegetation and/or managed wetlands, as required under SGMA (Emergency Regulations Section 354.18(a) and (b)(3)). The GSP only focused on a subset of water use sectors, such as urban and agricultural users of groundwater. This is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget nor will they likely be considered in project and management actions. ET of riparian use is estimated as potential ET, however there are very few sources for non-agricultural ET that are based on controlled studies. The Plan states that lack of ET on riparian vegetation is an issue for calibrating streamflow.

<u>TNC recommendation</u>: As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget. We suggest that the GSA consider using remote-sensing based ET measurements to quantify non-agricultural ET. Because ET is a major outflow component, we suggest that a discussion of the uncertainty in model results is included. A discussion on the use of solar radiation in model calibration and references on ET methodology would also improve the GSP.

Sustainable Management Criteria – We appreciate that the GSP includes and considers environmental beneficial uses and users of groundwater within the Sustainable Management Criteria. The GSP represents that there have been no detectable changes in streamflow in over 18 years of monitoring shallow groundwater; however, this finding is based on a few monitoring wells. The proposed eight new monitoring wells will provide additional information to improve the understand between ISWs and groundwater levels. TNC suggests that the MGA include metrics for assessing the temporal variation in vegetation stress and its correlation with groundwater levels.

The Monitoring Network - We would like to commend the GSP for developing a monitoring network for streamflow and aquifers. To improve monitoring for GDEs, TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess potential impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but *sustainable* groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Santa Cruz Mid-County Groundwater Basin Groundwater Sustainability Plan

The Santa Cruz Mid-County Groundwater Agency (MGA) Final Groundwater Sustainability Plan (GSP) for the Santa Cruz Mid-County Groundwater Basin, adopted on November 21, 2019, was reviewed by TNC. A summary of public comments on the Draft GSP is provided as Appendix B of the Final GSP. Responses to TNC's comments available on the MGA website are included as Attachment F. This attachment lists our original comments on the complete Draft GSP, as submitted to MGA during the public comment period, and states whether or not they were addressed in the Final GSP *[as green text in brackets]*. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 – Notice & Communication (23 CCR §354.10).

- *[The GSP text was updated to address our comment. Thank you for recognizing the importance of protected lands in the description of beneficial uses and users.]* [Section 2.1.5.1 Description of Beneficial Uses and Users in the Basin (pp. 2-52)] Please include the following in the list of beneficial uses and users of groundwater in the Basin: Protected Lands, including preserves, refuges, conservation areas, recreational areas and other protected lands; and Public Trust Uses, including wildlife, aquatic habitat, fisheries, recreation and navigation.

Checklist Item 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8).

- *[The GSP text was updated to address our comment. Thank you for addressing trends in groundwater and related surface water.]* [Section 2.1.2 Water Resources Monitoring and Management Programs (pp. 2-21 to 2-28)] Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater <u>*and related surface conditions*</u> (emphasis added). In order for this section to provide the appropriate context and help assure integration of GSP implementation with other ongoing regulatory programs, this section should describe the following:
    - *[The GSP text was updated to address our comment. Thank you for adding a discussion of monitoring activities related to aquatic resources.]* Monitoring activities and responsibilities by State, Federal and local agencies and jurisdictions related to aquatic resources and GDEs that could be affected by groundwater withdrawals should be discussed.
    - *[The GSP added text to provide link to the steelhead monitoring program webpage but did not articulate how steelhead monitoring overlaps with existing monitoring programs.]* Section 2.1.2.1 states that there is steelhead habitat monitoring by local agencies; however, there is no discussion on how the steelhead monitoring sites overlap with existing hydrologic monitoring (e.g., nested monitoring wells, stream gauges). A discussion on how

steelhead and hydrologic monitoring will be combined to characterize and monitor whether groundwater conditions are causing adverse impacts to this priority species (see Table 2-1) should be included in Sections 2.1.2.1 or 2.1.2.2.

  - *[The GSP text was updated to address our comment. Thank you for including a discussion regarding the management of critical habitat.]* The Critical Habitat for Threatened and Endangered Species website maintained by the US Fish and Wildlife Service (https://fws.maps.arcgis.com/home/webmap/viewer.html?webmap=9d8de5e265ad4fe09893cf75b8dbfb77) identifies lands with endangered and threatened species in the Basin, including species potentially associated with interconnected surface waters ISWs, including Steelhead (*Onocorhynchus mykiss*) and Tidewater goby (*Eucyclogobius newberryi*). Also please refer to the Critical Species Lookbook[2] to review and discuss the potential groundwater reliance of critical species in the basin. Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.

- [Section 2.1.3 Land Use Elements or Topic Categories of General Plans (pp. 2-29 to 2-36)]
  - *[The GSP text was updated to acknowledge that the Conservation and Open Space Element of the County General Plan includes policies for the protection and management of groundwater resources and recharge areas. Thank you for stating how implementation of the GSP will be coordinated with General Plan policies.]* This section should include a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals, rather than being limited to goals and policies directly related to groundwater resources alone. Section 2.1.3 does not identify any General Plan policies related to these resources. Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs.
  - *[The GSP text was updated to acknowledge that the Conservation and Open Space Element of the County General Plan is in the process of being updated and that wording has been proposed to incorporate references to the GSP in the General Plan. Thank you for clarifying that reference to the GSP will be incorporated in the General Plan.]* The Open Space and Conservation Element of the County's General Plan (http://www.sccoplanning.com/Portals/2/County/userfiles/106/GP_Chapter%205_Open%20Space_Conservation.pdf) requires a mapping program to determine the boundaries of sensitive habitats. Please include information from this program as it relates to the identification and management of GDEs under the GSP.

[2] Available online at: *https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/*

- *[The GSP text was updated to address our comment. Thank you for identifying relevant HCPs and NCCPs in the GSP.]* This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Basin and if they are associated with critical, GDE or ISW habitats such as the City of Santa Cruz's Anadromous Salmonid HCP www.cityofsantacruz.com/Home/ShowDocument?id=34225. Please identify all relevant HCPs and NCCPs within the Basin, and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.

- *[The GSP text was updated to address our comment. Thank you for acknowledging the importance of coordination of well permitting with the GSP's sustainability goals.]* [Section 2.1.3.4 Summary of the Process for Permitting New or Replacement Wells in the Basin] This section should include a discussion of the following:
  - Future well permitting must be coordinated with the GSP to assure achievement of the Plan's sustainability goals.
  - The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF v. SWRCB and Siskiyou County, No. C083239). The need for well permitting programs to comply with this requirement should be stated.

- [Section 2.1.4.12 Impacts on Groundwater Dependent Ecosystems]
  - *[The GSP text was updated to address our comment. Thank you for adding a discussion of the potential groundwater reliance of critical species in the basin.]* Please refer to the Critical Species Lookbook[3] to review and discuss the potential groundwater reliance of critical species in the basin.
  - *[Our comment was not addressed. No changes to GSP text made.]* Please include a description of the in-stream flow requirements for identified coho and steelhead salmon habitat and their relationship to the GSP.
  - *[Our comment was not addressed. No changes to GSP text made.]* Please identify groundwater-related knowledge and monitoring gaps for the critical species and GDEs identified in the Basin.

Checklist Items 6 and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

- *[The GSP text was updated to address our comment. Thank for you properly defining the vertical basin boundary.]* [Section 2.1.1.1.1 Santa Cruz Mid-County Basin (pp. 2-9 to 2-10)] The bottom boundary of the basin is imprecisely described as including the "Purisima Formation, Aromas Red Sands and certain other Tertiary-age aquifer units underlying the Purisima Formation." The bottom boundary of the basin should be more precisely defined in accordance with DWR guidance. As noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP

[3] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

(https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". Properly defining the bottom of the basin will prevent the possibility of extractors with wells deeper than the basin boundary from claiming exemption of SGMA due to their well residing outside the vertical extent of the basin boundary.

- *[The GSP text was updated to address our comment. Thank you for including a conceptual diagram showing the connections between Soquel Creek, Alluvium, and Underlying Aquifers. In addition, we appreciate that the GSP included a clear identification of data gaps and MGA intentions to fill those gaps.]* [Section 2.2.1.2 Geology and Geologic Structures (pp. 2-65 to 2-72)] The cross sections provided in Figures 2-15 and 2-16 are regional and highly generalized, and do not include a graphical representation of how shallow groundwater may interact with ISWs or GDEs that would allow the reader to understand this topic. Better conceptualization is provided in Figure 2-40; however, it would be helpful if this figure, or a similar figure reproduced in this section, were to include additional surface-groundwater interaction scenarios and GDEs. Please consider including an example near-surface cross section that depicts the conceptual understanding of shallow groundwater and stream interactions at different locations, including perched and regional aquifers as well as GDEs. If data are not available, please identify this as a knowledge gap and elaborate in the monitoring section how and where additional wells can reconcile this gap.

Checklist Items 8, 9 and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)

- [Section 2.2.2.6 Identification of Interconnected Surface Water Systems (pp. 2-114 to 2-121)]
  - *[The GSP text was updated to address our comment. Thank you for providing perspective on the total percentage of baseflow discharge as well as modeling uncertainties.]* On page 2-116 the third bullet states "Groundwater only contributes a small amount of flow (<0.5 cfs) to each of these segments in the months with lowest flows." While this is technically correct based on modeled results, this baseflow measurement is highly uncertain due to a lack of co-located stream gauges and nested or clustered groundwater wells throughout Soquel Creek. It is also potentially misleading since, for example Figures 2-41 shows that during 22 out of 27 years, the total flow in this reach of Soquel Creek was only 1.5 cfs or less. Please remove the word "only" and provide perspective on the total percentage of baseflow discharge included in dry month discharge, as well as modelling uncertainties.
  - *[No changes to the GSP text were made.]* This section should discuss or reference any in-stream flow requirements, especially flow needs for critical species, in each of the interconnected streams including the amount, time of year when the flow minimum is specified, the duration, the species for which it applies, associated permits that set forth the requirements, and the regulating agency setting forth the compliance requirements.
  - *[The GSP text was updated to address our comment. Thank you for clarifying where the recommendations for improvements to the monitoring network*

reside in the GSP.] On page 2-118, it is stated that the MGA intends to improve Basin monitoring to better understand surface-groundwater interactions over time. Nested monitoring wells would be helpful near surface water to show how pumping is impacting surface water flows and GDEs in all of the interconnected surface waterways (not just in Soquel Creek). More specifically, we suggest installing three nested wells perpendicular to Soquel Creek near several pumping wells (perhaps one in each gaining reach and one in the losing reach; Nob Hill, Simons, and Main Street), so that we can assess how well connected the A, AA and Tu formations are with Soquel Creek. This will also help to gauge what distance to the creek is most representative of a shallow groundwater gradient (to validate EDF's approach) and allow updating of the groundwater model as appropriate.

- *[Our comment was not addressed. No changes to GSP text made.]* Figure 2-9 provides good perspective on the potential connection between surface and groundwater for various streams and reaches and Section 2.2.2 provides a discussion regarding some of the reaches that are considered potentially most sensitive to streamflow depletion by groundwater extraction. However, more information is required to understand of how the connection is affected by year type and reach overall, and to substantiate prioritization of these stream reaches. We recommend that a table be included presenting estimates of current and historical surface water depletions for ISWs quantified and described by reach, season, and water year type.

Checklist Items 11 through 20 – Groundwater Dependent Ecosystems (23 CCR §354.16)

- [Section 2.2.2.7 Identification of Groundwater-Dependent Ecosystems (pp. 2-122 to 2-127)]
  - *[The GSP text was updated to address our comment. Thank you for clarifying that ISWs were located in riparian areas and for addressing other ecosystems in the GSP.]* On page 2-116 it is stated that the focus of GDE identification was narrowed to the habitats supported by surface water systems (i.e., those located near streams). Furthermore, it was stated that "… the group determined that any possible ecosystem effects would be challenging to evaluate, are likely quite small if they exist at all, and will benefit from the management policies put in place to protect priority aquatic species." Since, other GDEs may exist in areas of shallow groundwater away from streams, please provide a more substantial justification for focusing GDE identification efforts on riparian zones alone.
  - *[The GSP text was updated to address our comment. Thank you for clarifying that ISWs were located in riparian areas and for addressing other ecosystems in the GSP.]* Page 2-122 states that "Other ecosystems that were identified were found to be generally supported by interflow in perched groundwater, and surface runoff." The nature and locations of the "other ecosystems" is not discussed. Also, while the interflow hypothesis (redwood sponge effect) is potentially plausible, there is no evidence to support that this water is actually

soil water in the unsaturated zone versus groundwater flow in an aquifer that is interacting with other aquifer formations. This "interflow" should not be considered beyond the scope of GSP management, until it has been better characterized and shallow monitoring wells have been installed in the redwood-forested areas. SGMA defines aquifers as "a body of rock or sediment that is sufficiently porous and permeable to store, transmit, and yield significant or economic quantities of groundwater to wells and springs". Given the potential significance of "interflow" to ecosystems and surface water in Soquel Creek, more information is necessary to substantiate these statements. Other GDEs may exist in areas of shallow groundwater away from streams. Please provide additional details regarding the "other ecosystems" discussed on pages 2-116 and 2-122.

- *[GSP text changes were made; however, the spatial and temporal aspects were not fully addressed.]* Page 2-123 states that the map of GDEs in the Basin included as Figure 2-47 was developed using guidance developed by TNC. Please refer to Attachment C of this letter for best practices in using groundwater data to verify whether NCCAGs are GDEs. Please discuss what temporal and spatial data were used to identify GDE's presented in Figures 2-47 and 2-48 (and remove NCCAG polygons along groundwater-connected stream reaches) and identify any data gaps.
- *[Our comment was not addressed. No changes to GSP text made.]* SGMA defines GDEs as "ecological communities and species that depend on *groundwater emerging from aquifers or on groundwater occurring near the ground surface*". We recommend that depth to groundwater contour maps be used to verify whether a connection to groundwater exists for polygons in the NC Dataset, instead of relying on inferences based on the presence of surface water features in the Basin. Please refer to Appendix C of this letter for best practices for using groundwater data to verify a connection to groundwater.
- *[Our comment was not addressed. No changes to GSP text made.]* While depth to groundwater is generally accepted as being a proxy for confirming that polygons in the NC dataset are connected to groundwater, the variable needs of plant species and their dependence on seasonal and inter-annual groundwater level fluctuations should be considered when applying this criterion. The GSP does not cite what hydraulic criteria were used to establish a GDE. It is highly advised that seasonal and interannual fluctuations in the groundwater regime are taken into consideration.
- *[The GSP text was updated to address our comment. Thank you for pointing TNC to the relevant figures in the GSP and for providing additional detail regarding groundwater extraction and streamflow monitoring.]* The last bullet on page 2-124 states that modeling and management should focus on areas of highest groundwater extraction where streams are interconnected with groundwater. Please identify specifically where these areas are located.
- *[The GSP text was updated to address our comment. Thank you for substantially revising the description of the MGA's planning process to address GDEs.]* The first bullet on page 2-123, states that there are many factors beyond groundwater management that affect streamflow, that are beyond the

scope of the GSP yet were accounted for in the analysis. Please identify how these factors were accounted for in the analysis.
    - *[Our comment was not addressed. No changes to GSP text made.]* Very little description is provided regarding the nature and function of the identified GDEs, their potential sensitivity to groundwater and surface water supply changes, their relative habitat value. We recommend the inclusion of a discussion regarding the nature and characteristics of the identified GDEs.

Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)

- [Section 2.2.3 Water Budget Estimates (pp. 2-128 to 2-170)] The following items related to GDEs, wetlands and riparian areas should be clarified or considered:
    - *[Our comment was not addressed. No changes to GSP text made.]* Groundwater outflow to ET is not identified as a groundwater budget component (Table 2-9). Since wetlands, GDEs, and riparian vegetation are recognized as beneficial users of groundwater in the Basin, they should be included in the groundwater budget as ET demands. Calculations should be provided to quantify the amount of ET in the GDEs both spatially and temporally, including water year type. Please identify any data gaps.
    - [*Changes were made to the GSP text; however, the method used to quantify ET appears to be an estimate using temperature.*] "Evapotranspiration" is identified in Table 2-9 as a stream system water budget outflow component. It is not appropriate to identify the existence of GDEs, and then to assume that they meet all of their water demand through surface water and do not rely on groundwater to meet any demand. Please include an explanation of the approach to determining the amount of riparian ET demand met by streamflow both spatially and temporally, including water year type, and identify any data gaps.
    - *[Changes were made to the GSP text; however, the method used to quantify ET appears to be an estimate using temperature.]* Table 2-9 states that with regard to groundwater discharge to creeks, "… calibration to streamflow indicated groundwater interactions less significant than watershed characteristics." With regards to outflow of surface water to evapotranspiration, the table states that this value was derived "based on calibration of potential evapotranspiration. Both values were derived from the calibrated model, yet the GSP states that the model did not simulate evapotranspiration of groundwater. Please provide additional explanation regarding the approach used to determining the amount of evapotranspiration from riparian areas and other GDEs and what is meant by the statement that groundwater interactions are less important than watershed characteristics. Please also discuss the rationale for the simplifying modeling assumption that GDEs derive all of their water uptake from surface water, and identify any data gaps relative to assessment and management of GDEs. These critical and unverified assumptions could fundamentally alter the definition of GDEs in the basin, and subsequent evaluation in the plan.

- *[Changes were made to the GSP text; however, the changes did not fully address the comment regarding uncertainty.]* Shallow monitoring wells are only available for a portion of the Soquel Creek to validate shallow groundwater modeling and identifies this lack as a data gap (Page 2-131). Section 2.2.3.4.1 (p 2-135) identifies that the most important aspect of the surface water budget is its connection to groundwater for GDEs. Please provide additional evaluation and discussion regarding the level of uncertainty and limitations resulting from this data gap. Please evaluate the effect this data gap on the modeling results related to ISWs and surface-groundwater interaction by conducting a sensitivity analysis.

<u>Checklist Items 23 to 25 – Sustainability Goal (23 CCR §354.24)</u>

- *[Our comment was not addressed. No changes to GSP text made.]* [Section 3.1 Sustainability Goal (p. 3-1)] The sustainability goal includes maintaining groundwater contributions to streamflow; however, the needs of Steelhead and Coho are very specific in terms of seasonal needs for minimum flows and avoidance of sudden, even temporary, declines in interconnected surface water levels prior to the outmigration of fry. Please include streamflow for coho and steelhead habitat as a component of the sustainability goal.

<u>Checklist Item 26 – Measurable Objectives (23 CCR §354.30)</u>

- *[The GSP text was updated to address our comment. Thank you for providing more detail on the identification of GDEs and the uncertain relationship between groundwater levels and streamflow.]* [Section 3.2.2 Process of Developing Sustainable Management Criteria (p. 3-3 to 3-4)] No reference is made to the review of supporting documents for General Plan Conservation or Land Use Elements, or to the review of environmental management studies and documents such as Biological Assessments, Biological Opinions, HCPs, NCCPs, or other studies regarding the current and historical conditions of the beneficial uses being evaluated. Please provide detail on how sustainable management criteria were developed for GDEs and streamflow habitat, and how the above supporting documents were considered.

<u>Checklist Items 27 to 29 – Minimum Thresholds (23 CCR §354.28) and Checklist Items 30 to 46 – Undesirable Results (23 CCR §354.26)</u>

- [Section 3.4.2 Minimum Thresholds – Chronic Lowering of Groundwater Levels (p. 3-44 to 3-50)]
    - *[Our comment was not addressed. No changes to GSP text made.]* The relationship between the minimum threshold for chronic lowering of groundwater levels and potential significant and unreasonable impacts to GDEs and ecological beneficial uses of surface water is described on page 3-47 and is based on groundwater monitoring at a few wells on lower Soquel Creek. Please provide additional analysis to substantiate the potential

impacts of applying the proposed minimum thresholds will not cause significant and unreasonable impacts to GDEs and ecological beneficial uses of ISWs or identify this as a data gap.

- *[Our comment was not addressed. No changes to GSP text made.]* In Section 3.4.2.5 (pp. 3-49 to 3-50), the potential effects of undesirable results on environmental beneficial users are not adequately described and quantified. Text on p 3-56 states that "increasing groundwater levels above current levels will generally improve already sustainable conditions for GDEs. Please expand the section to describe the potential effects of undesirable results on all beneficial uses and users of including environmental uses and users.
- *[Our comment was not addressed. No changes to GSP text made.]* Section 3.4.2.6 (p. 3-50) states that there are no relevant local, state or federal standards for the chronic lowering of groundwater levels. Please include a reference to the appropriate section for minimum thresholds related to GDE's, and Coho and Steelhead streamflow habitat, and discuss the potential relationship between the proposed minimum threshold for chronic lowering of groundwater levels and these standards.

- [Section 3.9.1 Undesirable Results – Depletion of Interconnected Surface Water (pp. 3-90 to 3-92)]
  - *[The GSP text was updated to address our comment; however, the changes did not address the request to plot hydrologic data for locations with identified GDEs and instream flows.]* Section 3.9.1.1 presents the results of an analysis to assess whether groundwater level monitoring can serve as suitable surrogate to assess depletion of interconnected surface water. The section states that the analysis is conducted outside the calibrated use of the model, adding additional uncertainty to the results. An additional consideration is that the only shallow groundwater monitoring data available are in lower Soquel Creek, but GDEs and ISWs are located throughout the Basin. Finally, although the analysis aims to provide a correlation between groundwater levels and streamflow discharge, not attempt to make a correlation between groundwater levels and ecosystem response has been undertaken. The data gaps associated with establishment of minimum thresholds for depletion of ISW should be described and a plan provided to address them. To the extent data are available, please plot hydrologic data for locations with identified GDEs and instream flow requirements for coho and steelhead salmon. This is particularly important in areas identified in Section 3.9.1.3 (p. 3-91) where private domestic wells screened in shallow alluvial sediments are directly connected to surface water.

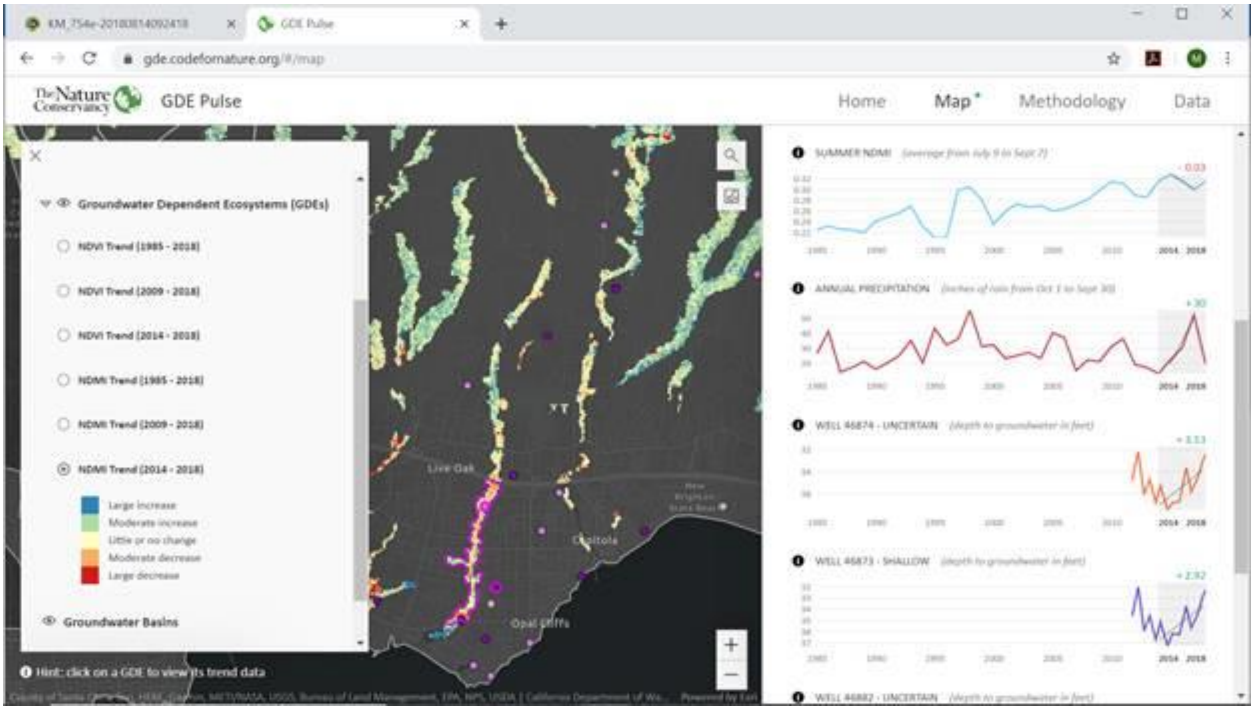
- [Section 3.9.2 Minimum Thresholds – Depletion of Interconnected Surface Water (pp. 3-92 to 3-96)
  - *[Our comment was not addressed. No changes to GSP text made.]* In Section 3.9.2, the minimum threshold is established as the highest seasonal low groundwater level elevation in shallow groundwater monitoring wells during below- average rainfall years from the start of monitoring through 2015.

While this threshold may deal with the uncertainty of establishing minimum thresholds where monitoring data are available, other GDEs throughout the basin lack the monitoring data for a reliable linkage between groundwater levels and ecosystem stress response. As such, the proposed minimum threshold is not proven to be correlated, and should not be assumed to be protective of GDE and ISW resources. Consideration should be given to establishing a minimum thresholds based on species or ecosystem responses as measured by biological monitoring or remote sensing, such as through the Steelhead monitoring program, by the GDE Pulse tool (Attachment D), and/or a similar approach.

  - *[Our comment was not addressed. No changes to GSP text made.]* Section 3.9.2.1 should reference rooting depth information for riparian vegetation in GDEs to help support the minimum thresholds for shallow groundwater elevations.

<u>Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)</u>

- [Section 3.3 Monitoring Network] The GSP proposes to use groundwater level monitoring for chronic groundwater level decline as a surrogate for monitoring the depletion of ISW. We have the following comments.
  - *[The GSP text was updated to address our comment; however, the changes did not fully address how groundwater levels will be used to assess impacts to ISWs and GDEs.]* Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater *<u>and related surface conditions</u>* (emphasis added). Groundwater level monitoring alone may be insufficient to establish a linkage between groundwater extraction and potentially resulting impacts to environmental resources associated with GDEs and ISWs. The cause-effect relationship between groundwater levels and the biological responses that could result in significant and unreasonable impacts to ISWs and GDEs depends on a number of complicated factors, and this relationship is not characterized or discussed. As such, it is not possible to determine whether the proposed monitoring, minimum thresholds and measurable objectives are sufficiently protective to ensure significant and unreasonable impacts to GDEs and ISWs will be prevented. The GDE Pulse interactive mapping application provides an example of a linkage between groundwater level data and GDE health that could be used to incorporate remote sensing into an efficient and incisive monitoring program (see screenshot example below). Please provide an explanation how groundwater levels will specifically be used to assess adverse impacts to GDEs and ISWs, and identify any data gaps and how they will be addressed.



- *[The GSP text was updated to address our comment. Thank you for describing data gaps and MGA's plans to fill those gaps.]* [Section 3.3.4.1 Groundwater Level Monitoring Data Gaps (p. 3-41)] Additional monitoring wells are proposed to measure groundwater levels and quality in critical areas where data are sparse. These include increased coverage are identified in the upper Soquel Creek watershed. We have the following comments.
    - The areas identified with potential GDEs (Figure 2-9) are located throughout the Basin; however, the only monitoring wells suitable for assessing impacts to GDEs and ISWs are on the lower reach of Soquel Creek. In Section 3.3.4.1, on page 3-41 and Figure 3-9, eight locations are proposed for installation of additional shallow monitoring wells to assess groundwater interaction with ISWs and GDEs. Locations should be prioritized near high value or sensitive resources that are vulnerable to significant and unreasonable impacts, such as where GDEs include habitat for protected species and are proximal to areas of groundwater extraction. These determinations should be vetted with agency officials responsible for the protection of the habitat and species involved. Please discuss the results of a resource assessment or consultations with resource managers that demonstrates a sufficient number of wells is proposed to address data gaps near GDEs and ISWs, and that they are being sited where they will provide the most benefit. Alternatively, please outline the process by which this will be accomplished.
    - *[Our comment was not addressed. No changes to GSP text made.]* As discussed in our comments above, please address how the need to link and correlate groundwater level declines to biological responses, and significant and adverse impacts to GDEs and ISWs will be addressed at the locations where additional wells are installed.

- *[The GSP text was updated to address our comment. Thank you for adding to the discussion of assessment and improvement of the monitoring network.]* Well sites near ISWs should be selected at varying distances from streams and completed as vertically-nested clusters to capture the lateral and vertical gradients between the pumped depths in the aquifer system and the shallow groundwater aquifers that are in communication with ISWs or GDEs. Ideally, co-locating stream gauges with clustered wells would enhance understanding about where ISWs exist in the basin and whether pumping is causing depletions of surface water or impacts on beneficial users of surface water and groundwater. There is a need to enhance monitoring of stream flow and vertical groundwater gradients by installing more stream gauges and clustered/nested wells near streams, rivers or wetlands.
- *[The GSP text was updated to address our comment. Thank you for describing the process of assessment and improvement of the monitoring network through time.]* Addressing data gaps is typically iterative and it is not reasonable to expect it will be a one-time process. Please describe the process by which data gaps will be identified and addressed on an ongoing basis.

- *[The GSP text was updated to address our comment. Thank you for clarifying the MGA's plans to leverage the existing data management system used by its member agencies.]* [Section 5.1.1.4 Data Collection, Analysis, and Reporting indicates that data regarding GDEs is not currently included in the proposed Data Management System. Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater *and related surface conditions* (emphasis added). You cannot manage what you do not measure. Please add a data collection, analysis and reporting category for GDEs and ISWs, and how it will be incorporated in the data management system to assess potential significant and unreasonable impacts to environmental beneficial uses and users.
- *[Our comment was not addressed. No changes to GSP text made.]* [Section 5.1.1.4.6 Data Collection: Other (p. 5-6)] This section states that additional data on fish and stream habitat will be developed; however, GDEs are not listed. Chapter 5 does not discuss using aerial imagery or remote sensing for GDE assessment, which is increasingly recognized as tool for efficient and objective direct monitoring of ecosystem health in GDEs and ISWs. Without establishing the appropriate linkages between groundwater level changes and GDE stress of vigor, groundwater level monitoring alone may be insufficient to assess whether the GSP is effectively preventing undesirable results. Please consider the potential use of remote sensing data and imagery as a monitoring tool, and expand it to monitoring surface indicators of ISW and GDE ecosystem health.
- *[Our comment was not addressed. No changes to GSP text made.]* [Section 5.3 Annual Reporting p 5-13]: This section lists the procedural and substantive requirements for annual reporting. Please add reporting metrics and maps that include the status of GDEs, ISW, and fish habitat.

Checklist Items 50 and 51 – Project and Management Actions (23 CCR §354.44)

- *[GSP text changes were made to acknowledge the request; however, there is very little information to support the revisions. The GSP would benefit from additional* *description of the multiple benefits and environmental benefits of various projects.]* [Section 4 Projects and Management Actions (p. 4-1)] The Basin includes many GDEs and ISWs which represent beneficial uses and users of groundwater, and include potentially sensitive resources and protected lands. Environmental resource protection needs should be considered in establishing project priorities. In addition, consistent with existing grant and funding guidelines for SGMA-related work, priority should be given to multi-benefit projects that can address water quantity as well as providing environmental benefits or benefits to disadvantaged communities. Please include a section on project selection criteria and include environmental benefits and multiple benefits as criteria for assessing project priorities.

- *[Our comment was not addressed. No changes to GSP text made.]* Table 4-1 (pp. 4-2 to 4-7) lists potential projects and the Measurable Objective that is expected to benefit. Only water supply benefits are listed, but maintenance or recovery of groundwater levels, or construction of recharge facilities, also will have environmental benefits in many cases. From the table, it is not possible to distinguish the full range of project benefits or how the projects will be prioritized. It would be advantageous to demonstrate multiple benefits from a funding and prioritization perspective.
- [Section 4, Table 4-2 Identified Potential Future Projects and Management Actions (Group 3) pp. 4-3 to 4-4)]
    - *[Our comment was not addressed. No changes to GSP text were made at this time; however, MGA will consider this comment in future GSP updates.]* For the future projects identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.
    - *[Our comment was not addressed. No changes to GSP text made.]* If ISWs will not be adequately protected by those listed, please include and describe additional management actions and projects targeted for protecting ISWs.
    - *[Our comment was not addressed. No changes to GSP text made.]* Recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such facilities have been incorporated into local HCPs, more fully recognizing the value of the habitat that they provide and the species they support. For projects that will be constructing recharge ponds, please consider identifying if there will be habitat value incorporated into the design and how the recharge ponds will be managed to benefit environmental users.
    - *[Our comment was not addressed. No changes to GSP text made.]* Specific examples of how project descriptions may be refined to incorporate environmental benefits include the following:
        - Group 3 Groundwater Pumping Curtailment and or Restrictions. This project is designed to address seawater intrusion. Please consider expanding the policy to curtail and or restrict groundwater extractions to include areas identified with GDEs, ISW, or fish habitat that might be impacted.
        - For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

- *[Our comment was not addressed. No changes to GSP text made.]* [Section 5.1.1.3 Management and Coordination (p. 5-3)] This section describes technical work to support the GSP; however, the theme of the description is that the focus is on water supply and seawater issues. Please expand the narrative to include GDEs, ISW, and fish habitat. For example, under Section 5.1.1.4.4 Monitoring: Streamflow (p 6-6) there is acknowledgement that MGA member agencies use streamflow monitoring for fish habitat, but with the proposed new gauges there is no mention of using the data to support monitoring of GDEs, ISW, or fish habitat. Please incorporate these monitoring components where appropriate. Also, the there is no discussion of management actions that will be taken to assure SGMA compliance if monitoring data indicate that measurable objectives or interim milestones for GDEs or ISWs are not being achieved, or if data indicate that minimum thresholds will be violated. An adaptive management approach, where monitoring data are used to assess results and inform refinement of the management approach is typically specified. Please identify what management actions will be taken if monitoring data indicate that Measurable Objectives or Interim Milestones are not being achieved, or undesirable results are imminent.

Attachment C

Freshwater Species Located in the Santa Cruz Mid-County Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Santa Cruz Mid-County Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the Santa Cruz Mid-County groundwater basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[4]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[5] as well as on The Nature Conservancy's science website[6].

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
BIRD				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority

[4] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[5] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[6] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			

Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Rynchops niger	Black Skimmer			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
CRUSTACEAN				
Americorophium spinicorne				Not on any status lists
Americorophium spp.	Americorophium spp.			
Crangonyx spp.	Crangonyx spp.			
Cyprididae fam.	Cyprididae fam.			
Gammarus spp.	Gammarus spp.			
Gnorimosphaeroma spp.	Gnorimosphaeroma spp.			
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
Ramellogammarus spp.	Ramellogammarus spp.			
FISH				
Eucyclogobius newberryi	Tidewater goby	Endangered	Special Concern	Vulnerable - Moyle 2013
Oncorhynchus mykiss - CCC winter	Central California coast winter steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Catostomus occidentalis mnioltiltus	Monterey sucker			Least Concern - Moyle 2013
Cottus aleuticus	Coastrange sculpin			Least Concern - Moyle 2013

Cottus asper ssp. 1	Prickly sculpin			Least Concern - Moyle 2013
Entosphenus tridentata ssp. 1	Pacific lamprey		Special	Near-Threatened - Moyle 2013
Eucyclogobius newberryi	Tidewater goby	Endangered	Special Concern	Vulnerable - Moyle 2013
Gasterosteus aculeatus aculeatus	Coastal threespine stickleback			Least Concern - Moyle 2013
Gasterosteus aculeatus microcephalus	Inland threespine stickleback		Special	Least Concern - Moyle 2013
Lavinia exilicauda harengeus	Monterey hitch		Special	Vulnerable - Moyle 2013
Lavinia symmetricus subditus	Monterey roach		Special Concern	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		Special Concern	Near-Threatened - Moyle 2013
Oncorhynchus mykiss - CCC winter	Central California coast winter steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus mykiss - SCCC	South Central California coast steelhead	Threatened	Special Concern	Vulnerable - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
Rhinichthys osculus ssp. 1	Sacramento speckled dace			Least Concern - Moyle 2013
HERP				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC

Ambystoma macrodactylum	Long-toed salamander			
Ambystoma macrodactylum croceum	Santa Cruz Long-toed Salamander	Endangered	Endangered	
Anaxyrus boreas boreas	Boreal Toad			
Dicamptodon ensatus	California Giant Salamander			ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
Pseudacris sierra	Sierran Treefrog			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis atratus atratus	Santa Cruz Gartersnake			Not on any status lists
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis elegans terrestris	Coast Gartersnake			Not on any status lists
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECT & OTHER INVERT				
Acentrella spp.	Acentrella spp.			
Aeshna spp.	Aeshna spp.			
Agabus spp.	Agabus spp.			
Agapetus spp.	Agapetus spp.			
Alotanypus spp.	Alotanypus spp.			
Ameletus spp.	Ameletus spp.			
Amiocentrus aspilus	A Caddisfly			
Ampumixis dispar				Not on any status lists
Anagapetus spp.	Anagapetus spp.			
Anax spp.	Anax spp.			
Antocha spp.	Antocha spp.			
Apedilum spp.	Apedilum spp.			
Argia spp.	Argia spp.			
Baetidae fam.	Baetidae fam.			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brachycentridae fam.	Brachycentridae fam.			

Brillia spp.	Brillia spp.			
Brundiniella spp.	Brundiniella spp.			
Calineuria californica	Western Stone			
Callibaetis spp.	Callibaetis spp.			
Centroptilum spp.	Centroptilum spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chloroperlidae fam.	Chloroperlidae fam.			
Cinygmula spp.	Cinygmula spp.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Cordulegaster dorsalis	Pacific Spiketail			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Cricotopus trifascia				Not on any status lists
Cryptochironomus spp.	Cryptochironomus spp.			
Cultus spp.	Cultus spp.			
Diamesa spp.	Diamesa spp.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Dixidae fam.	Dixidae fam.			
Drunella coloradensis	A Mayfly			
Drunella flavilinea	A Mayfly			
Drunella spp.	Drunella spp.			
Dytiscidae fam.	Dytiscidae fam.			
Ecdyonurus criddlei	A Mayfly			
Ecdyonurus spp.	Ecdyonurus spp.			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Epeorus spp.	Epeorus spp.			
Ephemerella maculata	A Mayfly			
Ephemerella spp.	Ephemerella spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Ephydridae fam.	Ephydridae fam.			
Erythemis collocata	Western Pondhawk			
Eubrianax edwardsii				Not on any status lists
Eukiefferiella claripennis				Not on any status lists
Eukiefferiella devonica				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Gerridae fam.	Gerridae fam.			
Glossosoma spp.	Glossosoma spp.			
Glossosomatidae fam.	Glossosomatidae fam.			
Gomphidae fam.	Gomphidae fam.			

Gumaga spp.	Gumaga spp.			
Helichus spp.	Helichus spp.			
Heptageniidae fam.	Heptageniidae fam.			
Hesperoperla pacifica	Golden Stone			
Hesperoperla spp.	Hesperoperla spp.			
Heterotrissocladius spp.	Heterotrissocladius spp.			
Homoplectra oaklandensis	A Caddisfly			
Hydrophilidae fam.	Hydrophilidae fam.			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ironodes spp.	Ironodes spp.			
Isoperla spp.	Isoperla spp.			
Lara spp.	Lara spp.			
Lepidostoma spp.	Lepidostoma spp.			
Lestes stultus	Black Spreadwing			
Leucrocuta spp.	Leucrocuta spp.			
Limnephilidae fam.	Limnephilidae fam.			
Limnophyes spp.	Limnophyes spp.			
Malenka spp.	Malenka spp.			
Maruina lanceolata				Not on any status lists
Matriella teresa	A Mayfly			
Meringodixa chalonensis				Not on any status lists
Micrasema spp.	Micrasema spp.			
Micropsectra spp.	Micropsectra spp.			
Microtendipes spp.	Microtendipes spp.			
Mideopsis spp.	Mideopsis spp.			
Mystacides alafimbriatus	A Caddisfly			
Mystacides sepulchralis	A Caddisfly			
Nanocladius spp.	Nanocladius spp.			
Narpus spp.	Narpus spp.			
Nemouridae fam.	Nemouridae fam.			
Neophylax rickeri	A Caddisfly			
Neophylax spp.	Neophylax spp.			
Nixe kennedyi	A Mayfly			
Octogomphus specularis	Grappletail			
Ophiogomphus spp.	Ophiogomphus spp.			
Optioservus quadrimaculatus				Not on any status lists
Optioservus spp.	Optioservus spp.			

Ordobrevia nubifera				Not on any status lists
Oreodytes spp.	Oreodytes spp.			
Osobenus yakimae	Yakima Springfly			
Paracladopelma spp.	Paracladopelma spp.			
Parakiefferiella spp.	Parakiefferiella spp.			
Paraleptophlebia spp.	Paraleptophlebia spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Parapsyche spp.	Parapsyche spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Pentaneura spp.	Pentaneura spp.			
Perlidae fam.	Perlidae fam.			
Phaenopsectra spp.	Phaenopsectra spp.			
Plathemis lydia	Common Whitetail			
Plumiperla spp.	Plumiperla spp.			
Polycentropus spp.	Polycentropus spp.			
Polypedilum scalaenum				Not on any status lists
Polypedilum spp.	Polypedilum spp.			
Polypedilum tritum				Not on any status lists
Postelichus spp.	Postelichus spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Psychodidae fam.	Psychodidae fam.			
Psychoglypha spp.	Psychoglypha spp.			
Psychomyia spp.	Psychomyia spp.			
Ptychoptera spp.	Ptychoptera spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhithrogena spp.	Rhithrogena spp.			
Rhyacophila betteni	A Caddisfly			
Rhyacophila spp.	Rhyacophila spp.			
Robackia spp.	Robackia spp.			
Sanfilippodytes spp.	Sanfilippodytes spp.			
Scirtidae fam.	Scirtidae fam.			
Serratella micheneri	A Mayfly			
Serratella spp.	Serratella spp.			
Sialis spp.	Sialis spp.			
Sigara mckinstryi	A Water Boatman			Not on any status lists
Simulium spp.	Simulium spp.			
Siphlonurus spp.	Siphlonurus spp.			
Skwala spp.	Skwala spp.			
Sperchon spp.	Sperchon spp.			
Stenochironomus spp.	Stenochironomus spp.			
Sublettea spp.	Sublettea spp.			
Suwallia spp.	Suwallia spp.			

Sympetrum corruptum	Variegated Meadowhawk			
Sympetrum pallipes	Striped Meadowhawk			
Tanytarsus spp.	Tanytarsus spp.			
Thienemannimyia spp.	Thienemannimyia spp.			
Tinodes spp.	Tinodes spp.			
Tipulidae fam.	Tipulidae fam.			
Tricorythodes spp.	Tricorythodes spp.			
Tvetenia spp.	Tvetenia spp.			
Wormaldia occidea	A Caddisfly			
Wormaldia spp.	Wormaldia spp.			
Zaitzevia spp.	Zaitzevia spp.			
Zapada spp.	Zapada spp.			
Zavrelimyia spp.	Zavrelimyia spp.			
MOLLUSK				
Anodonta californiensis	California Floater		Special	
Galba spp.	Galba spp.			
Gyraulus spp.	Gyraulus spp.			
Hydrobiidae fam.	Hydrobiidae fam.			
Lymnaea spp.	Lymnaea spp.			
Lymnaeidae fam.	Lymnaeidae fam.			
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Planorbidae fam.	Planorbidae fam.			
Sphaeriidae fam.	Sphaeriidae fam.			
PLANT				
Alnus rhombifolia	White Alder			
Alnus rubra	Red Alder			
Alopecurus carolinianus	Tufted Foxtail			
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Anemopsis californica	Yerba Mansa			
Aquilegia eximia	Van Houtte's Columbine			
Arundo donax	NA			
Azolla filiculoides	NA			
Azolla microphylla	Mexican mosquito fern		Special	CRPR - 4.3
Baccharis glutinosa	NA			Not on any status lists
Baccharis salicina				Not on any status lists
Berula erecta	Wild Parsnip			
Bidens laevis	Smooth Bur-marigold			
Calamagrostis nutkaensis	Pacific Small-reedgrass			

Callitriche marginata	Winged Water-starwort			
Callitriche palustris	Vernal Water-starwort			
Callitriche trochlearis	Waste-water Water-starwort			
Calochortus uniflorus	Shortstem Mariposa Lily		Special	CRPR - 4.2
Campanula californica	Swamp Harebell		Special	CRPR - 1B.2
Carex amplifolia	Bigleaf Sedge			
Carex comosa	Bristly Sedge		Special	CRPR - 2B.1
Carex densa	Dense Sedge			
Carex harfordii	Harford's Sedge			
Carex hendersonii	Henderson's Sedge			
Carex lasiocarpa	Slender Sedge		Special	CRPR - 2B.3
Carex nudata	Torrent Sedge			
Carex obnupta	Slough Sedge			
Carex scoparia scoparia	Broom Sedge		Special	CRPR - 2B.2
Carex senta	Western Rough Sedge			
Ceratophyllum demersum	Common Hornwort			
Cicendia quadrangularis	Oregon Microcala			
Cicuta douglasii	Western Water-hemlock			
Cirsium douglasii douglasii	Douglas' Thistle			
Cirsium fontinale campylon	Mt. Hamilton Thistle		Special	CRPR - 1B.2
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Crypsis vaginiflora	NA			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus involucratus	NA			
Datisca glomerata	Durango Root			
Downingia pulchella	Flat-face Downingia			
Echinodorus berteroi	Upright Burhead			
Elatine brachysperma	Shortseed Waterwort			
Elatine californica	California Waterwort			
Elatine heterandra	Mosquito Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			

Eleocharis ovata				Not on any status lists
Eleocharis palustris	Creeping Spikerush			
Eleocharis parishii	Parish's Spikerush			
Eleocharis rostellata	Beaked Spikerush			
Epilobium campestre	NA			Not on any status lists
Epilobium hallianum				Not on any status lists
Epipactis gigantea	Giant Helleborine			
Eragrostis hypnoides	Teal Lovegrass			
Eryngium aristulatum aristulatum	California Eryngo			
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Galium trifidum	Small Bedstraw			
Gratiola ebracteata	Bractless Hedge-hyssop			
Helenium bigelovii	Bigelow's Sneezeweed			
Helenium puberulum	Rosilla			
Hydrocotyle ranunculoides	Floating Marsh-pennywort			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Isoetes howellii	NA			
Isoetes nuttallii	NA			
Isoetes orcuttii	NA			
Isolepis cernua	Low Bulrush			
Jaumea carnosa	Fleshy Jaumea			
Juncus acuminatus	Sharp-fruit Rush			
Juncus effusus pacificus				
Juncus hesperius				Not on any status lists
Juncus phaeocephalus paniculatus	Brownhead Rush			
Juncus phaeocephalus phaeocephalus	Brown-head Rush			
Juncus xiphioides	Iris-leaf Rush			
Lemna gibba	Inflated Duckweed			
Lemna minor	Lesser Duckweed			
Lemna minuta	Least Duckweed			
Lemna turionifera	Turion Duckweed			
Lemna valdiviana	Pale Duckweed			
Lepidium oxycarpum	Sharp-pod Pepper-grass			
Lilium pardalinum pardalinum	Leopard Lily			

Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limnanthes douglasii nivea	Douglas' Meadowfoam			
Limnanthes douglasii rosea	Douglas' Meadowfoam			
Limonium californicum	California Sea-lavender			
Limosella acaulis	Southern Mudwort			
Limosella aquatica	Northern Mudwort			
Ludwigia palustris	Marsh Seedbox			
Ludwigia peploides peploides	NA			Not on any status lists
Lupinus polyphyllus polyphyllus	Bigleaf Lupine			
Lysichiton americanus	Yellow Skunk-cabbage			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus guttatus	Common Large Monkeyflower			
Myosurus minimus	NA			
Myriophyllum aquaticum	NA			
Najas guadalupensis guadalupensis	Southern Naiad			
Navarretia intertexta	Needleleaf Navarretia			
Oenanthe sarmentosa	Water-parsley			
Panicum acuminatum acuminatum				Not on any status lists
Paspalum distichum	Joint Paspalum			
Perideridia californica	California Yampah			
Perideridia gairdneri gairdneri	Gairdner's Yampah		Special	CRPR - 4.2
Perideridia kelloggii	Kellogg's Yampah			
Perideridia oregana	Oregon Yampah			
Persicaria amphibia				Not on any status lists
Persicaria hydropiperoides				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phacelia distans	NA			
Phragmites australis australis	Common Reed			

Plagiobothrys chorisianus	NA		Special	CRPR - 1B.2
Plagiobothrys reticulatus reticulatus				Not on any status lists
Plagiobothrys undulatus	NA			Not on any status lists
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pleuropogon californicus californicus				Not on any status lists
Populus trichocarpa	NA			Not on any status lists
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton gramineus	Grassy Pondweed			
Potamogeton illinoensis	Illinois Pondweed			
Potamogeton natans	Floating Pondweed			
Potamogeton nodosus	Longleaf Pondweed			
Potamogeton pusillus pusillus	Slender Pondweed			
Potentilla anserina anserina				Not on any status lists
Psilocarphus brevissimus multiflorus	Delta Woolly Marbles		Special	CRPR - 4.2
Psilocarphus tenellus	NA			
Ranunculus lobbii	Lobb's Water Buttercup		Special	CRPR - 4.2
Ranunculus pusillus pusillus	Pursh's Buttercup			
Ranunculus repens	NA			
Rhododendron columbianum				Not on any status lists
Rhododendron occidentale occidentale	Western Azalea			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rorippa palustris palustris	Bog Yellowcress			
Rumex conglomeratus	NA			
Rumex occidentalis				Not on any status lists
Rumex salicifolius salicifolius	Willow Dock			
Ruppia cirrhosa	Widgeon-grass			
Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Salix babylonica	NA			
Salix exigua exigua	Narrowleaf Willow			

Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Salix sitchensis	Sitka Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus americanus	Three-square Bulrush			
Schoenoplectus californicus	California Bulrush			
Schoenoplectus pungens pungens	NA			
Scirpus microcarpus	Small-fruit Bulrush			
Senecio hydrophilus	Great Swamp Ragwort			
Sequoia sempervirens				
Sisyrinchium californicum	Golden Blue-eyed-grass			
Solidago elongata				Not on any status lists
Sparganium eurycarpum eurycarpum				
Spartina foliosa	California Cordgrass			
Spiranthes romanzoffiana	Hooded Ladies'-tresses			
Stachys ajugoides	Bugle Hedge-nettle			
Stachys albens	White-stem Hedge-nettle			
Stachys chamissonis chamissonis	Coast Hedge-nettle			
Stachys pycnantha	Short-spike Hedge-nettle			
Stachys rigida quercetorum				Not on any status lists
Stuckenia pectinata				Not on any status lists
Suaeda calceoliformis	American Sea-blite			
Symphyotrichum lanceolatum lanceolatum	NA			
Symphyotrichum lentum	Suisun Marsh Aster		Special	CRPR - 1B.2
Toxicoscordion venenosum venenosum				Not on any status lists
Triglochin maritima	Common Bog Arrow-grass			

Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica americana	American Speedwell			
Veronica anagallis-aquatica	NA			
Veronica catenata	NA			Not on any status lists
Wolffiella lingulata	Tongue Bogmat			
Zannichellia palustris	Horned Pondweed			

Attachment D

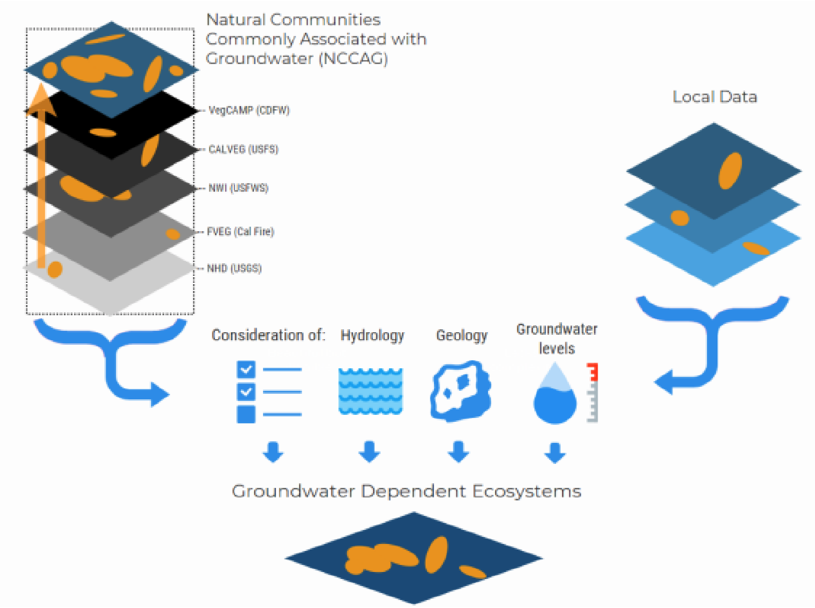
The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[7] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[8]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[7] *NC Dataset Online Viewer:* *https://gis.water.ca.gov/app/NCDatasetViewer/*

[8] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[9]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[10] on the Groundwater Resource Hub[11], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[9] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[10] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[11] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

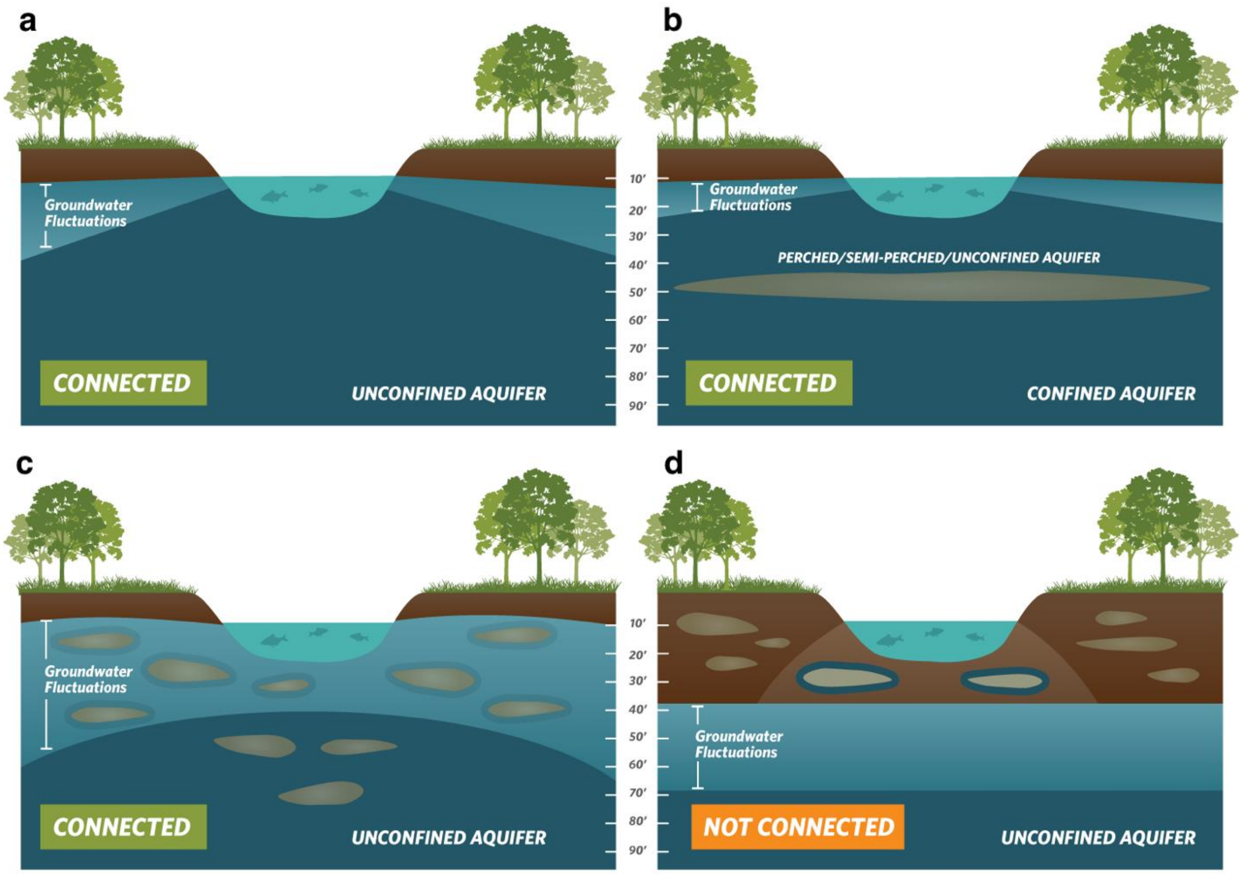

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[12] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[13] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[14] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[15]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network (see Best Practice #6).

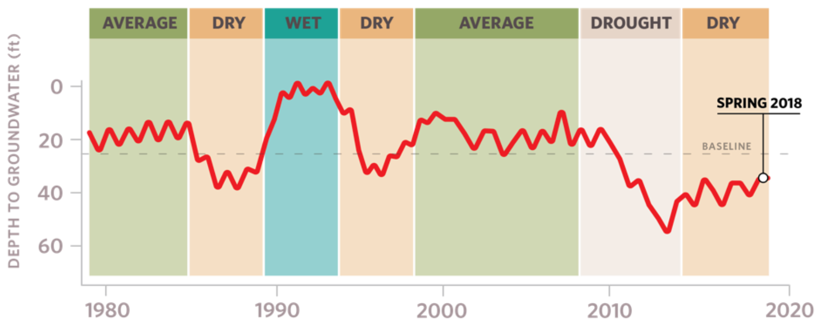

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[12] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[13] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[14] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[15] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[16], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

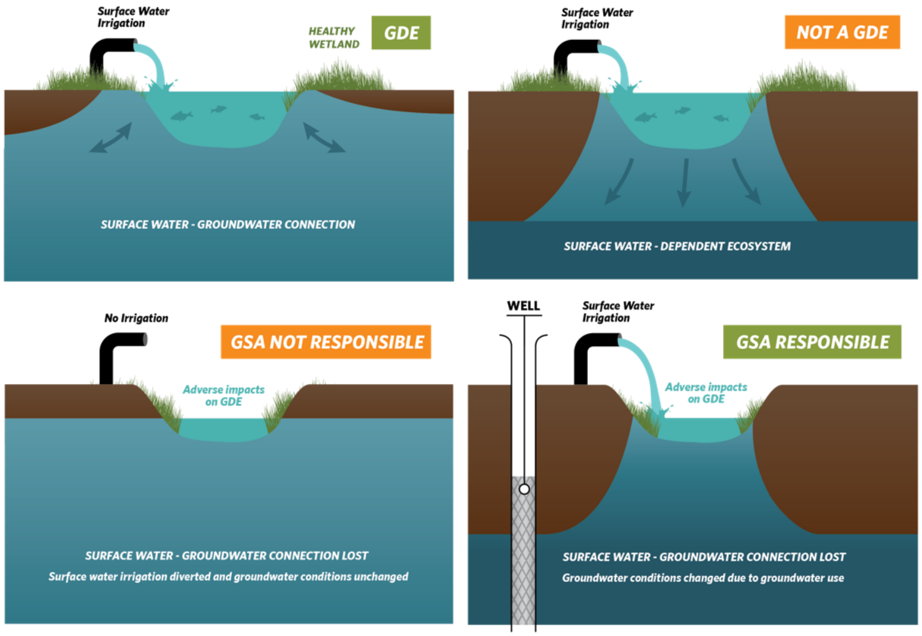

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[16] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

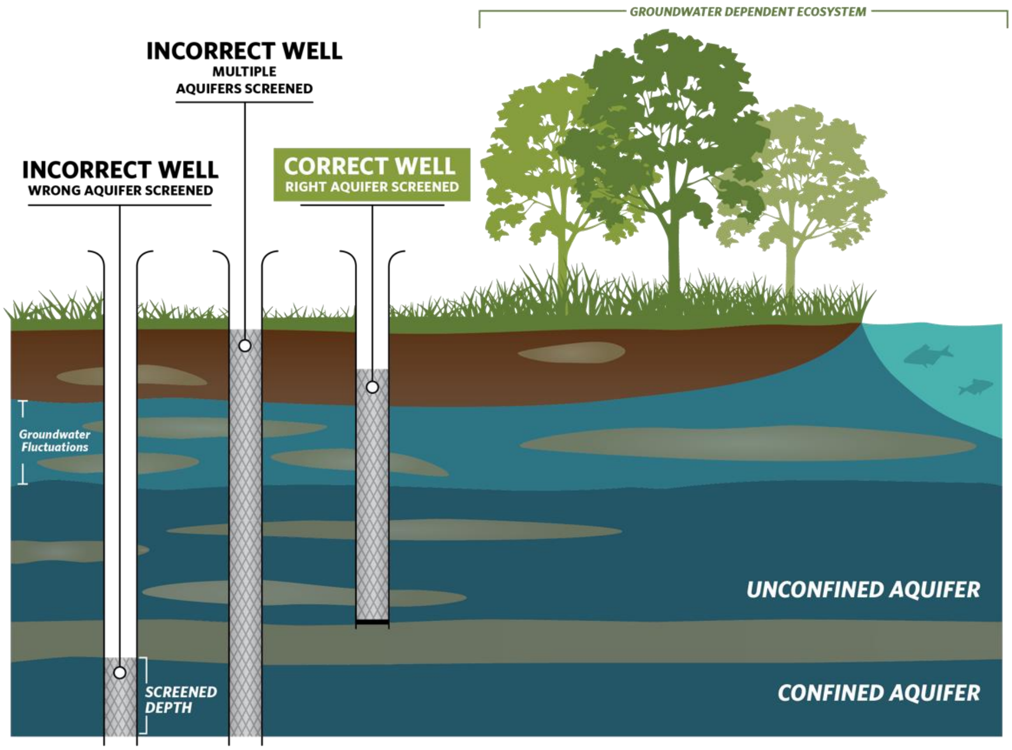

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[17] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

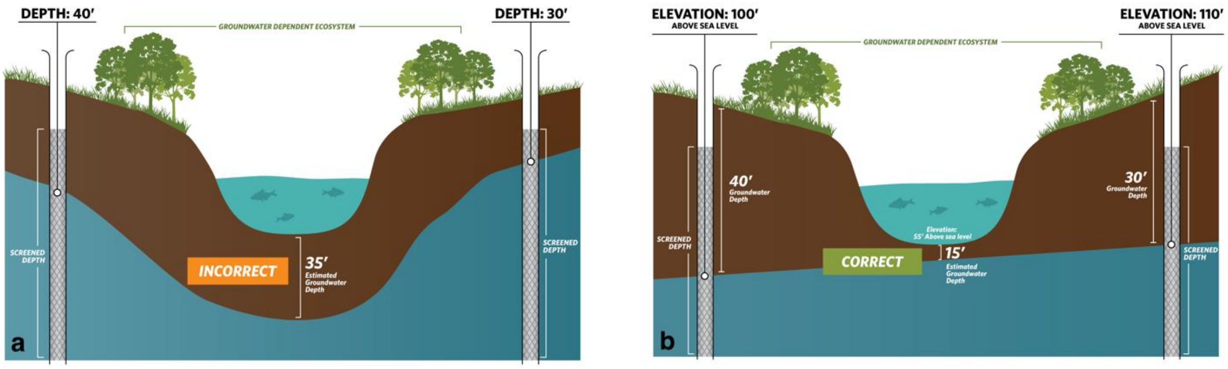

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

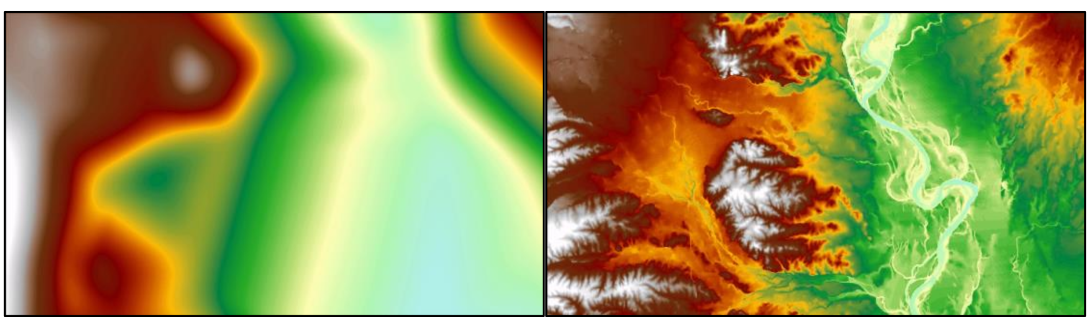

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[17] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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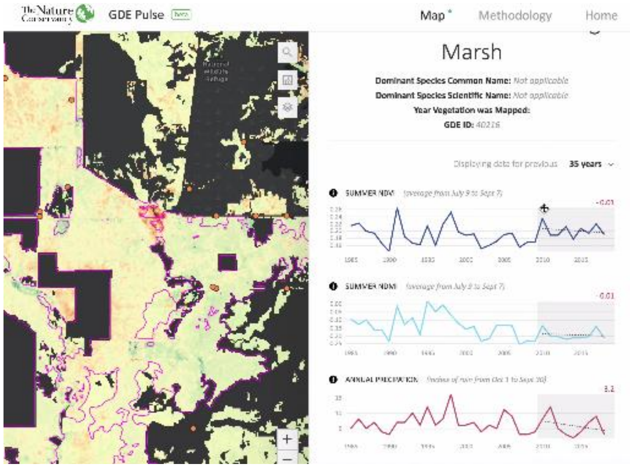

Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[18]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[19]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[18] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[19] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F

The GSA Response to TNC Comments on the Draft GSP is located on the DWR SGMA portal as attachment Part 2 of 2 of TNC's comments.

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[20]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[21]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[22] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[20] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[21] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[22] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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June 3, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Semitropic Water Storage District Management Area Plan for the Kern Groundwater Authority Groundwater Sustainability Plan, Kern County Subbasin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Semitropic Water Storage District Groundwater Sustainability Agency's (GSA's) Management Area Plan (MAP or Plan) in the Kern Groundwater Authority Groundwater Sustainability Plan (GSP) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing *sustainable* groundwater management from the status quo.

TNC Summary of MAP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be incomplete in addressing environmental beneficial uses and users. While the MAP addressed environmental beneficial users in some respects, our review finds that portions of the MAP and GSP should be remedied before being approved. Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some case, it may be difficult to address gaps within 180 days. In these cases, we strongly recommend that the Department set clear expectations that these be corrected in the 2025 plan update, and to the degree that gaps are due to lack of data, that these data gaps be addressed to inform the 2025 update.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Kern County Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides a map and method summary of potential ISWs.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft MAP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. While the GSA incorporated a portion of our feedback (4 of 20 comments were adequately addressed) we disagree with the components where our feedback was ignored or dismissed. This suggests a limited degree of engagement of environmental beneficial users and could result in a definition of sustainability that is biased towards a limited set of users in the basin. In our experience, the MAP did not "adequately respond to comments that raise credible technical or policy issues with the Plan," (23 CCR §355.4(b)(10).

TNC recommendation: We recommend that the GSA prioritize stakeholder engagement through improvements to the stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the MAP does not adequately incorporate feedback from environmental beneficial users, we also recommend the MAP revisit all components of the plan where beneficial users must be considered, especially in determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters – The MAP incorrectly excluded potential and/or actual ISWs because the plan did not employ the best available science. The MAP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). For example, Poso Creek was removed based on an incorrect assumption that ephemeral creeks cannot be ISWs. Potential ISWs such as Jerry Slough and the Kern River Channel were excluded because they receive managed surface water deliveries or are sustained by imported surface water. ISWs were excluded based on lack of continuous saturation between surface water and groundwater. These justifications of automatic removal are inconsistent with the definition of ISWs. The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "A*t any point*" (emphasis added) has both a spatial and temporal component. Even short durations of interconnection between groundwater and surface water can be crucial for surface water flow and support of wetlands. Using a temporal cut-off method, particularly when monitoring wells and stream gauges are recognized as data gaps, will not adequately protect the environmental beneficial uses of surface water from significant and unreasonable adverse impacts related to groundwater extraction.

Map and Assessment of potential ISWs:
By combining multiple years and seasons of groundwater depth data, The Nature Conservancy's assessment found that within the portions Semitropic Water Storage District MAP where sufficient data exist, 16.3 river miles are likely to be gaining, 0.5 are likely to be losing, and the rest are uncertain or likely disconnected (based on streams with available groundwater depth data). Importantly, TNC's analysis excludes the northwest portions of the plan area, where a significant number of potential ISWs are found. Attachment F contains a one-page method summary and a MAP-specific map of ISWs. The interconnected surface water displayed on the map is based on the minimum groundwater depth estimated by the California Department of Water Resources between 2011 and 2018.

Note: In most cases, the groundwater depth data used to generate the ISW map does not include perched aquifers. As such, some streams marked as disconnected could in actuality, be connected.

TNC recommendation: Until a disconnection is proven, TNC recommends that the MAP include all potential ISWs. In addition, TNC recommends that the GSA perform additional analysis based on quantitative measurement data to conclusively determine whether ISWs (e.g., Poso Creek, Jerry Slough and the Kern River Channel) exist in the Semitropic Area. Where data gaps exist, we recommend that the MAP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystems – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 26,973 acres of potential GDEs occur in the Semitropic GSA boundary. TNC developed the *Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs*[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

TNC appreciates the GSA's efforts to characterize and describe impacts to GDEs in the MAP. We appreciate Semitropic Water Storage District GSA for addressing data gaps related to GDEs in the MAP's proposed projects and management actions and adding a new management action in response to TNC's comments on the draft MAP. Management Action 6 – Evaluation and Assessment of GDEs within the Semitropic Area consists of conducting additional analyses to verify the presence and extent of GDEs and to develop appropriate monitoring protocols to address GDEs, if present. However, the MAP also asserts that ISWs and GDEs receiving surface water imports are not reliant on groundwater, which is unfounded.

TNC recommendation: TNC recommends that the GSA analyze groundwater levels to verify whether or not shallow groundwater conditions exist and are supporting GDEs.

Water Budget – We were disappointed to see that the water budget did not include the current, historical and projected demands of native vegetation or managed wetlands, as required under SGMA (23 CCR §354.18(a) and (b)(3)). In addition, the MAP did not include land with native vegetation in the water budget because it was assumed that evapotranspiration (ET) by native vegetation is met solely by precipitation, which underestimates GDE water needs because they rely, at least partially, on groundwater. Managed wetlands, many of which rely on groundwater, were also excluded. Therefore, GDEs and managed wetlands are not addressed in the water budget for the Subbasin in the MAP or GSP. This is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget nor will they likely be considered in project and management actions.

TNC recommendation: As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget, including groundwater ET and surface water demand to ET of GDEs.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts

[1] Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). The depletion of interconnected surface water sustainability indicator was not included in the MAP. This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

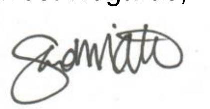
<u>TNC recommendation:</u> As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the MAP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users, especially those associated with the Kern National Wildlife Refuge, and those that are already protected under pre-existing state or federal law.

The Monitoring Network – While the monitoring network adequately monitors groundwater in the upper unconfined and lower confined aquifers, the network does not monitor the shallow zone. Because the shallow zone is the groundwater-bearing unit that would most likely be connected to GDEs and ISWs and yield water to these beneficial users, GDEs and ISWs are not being addressed in the MAP.

<u>TNC recommendation:</u> TNC recommends that the MAP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to verify possible GDEs and reaches that include ISWs; (2) modify the well network to develop plans for the construction of monitoring wells at the shallow zone near GDEs and ISWs in order to calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions required under SGMA (23 CCR §354.34(c)(6) and (f)(3); and (3) discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but *sustainable* groundwater management that considers the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,



Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Semitropic Water Storage District Groundwater Sustainability Plan

The Semitropic Water Storage District (SWSD) Groundwater Sustainability Agency (GSA) Groundwater Sustainability Plan[2] (GSP), adopted on December 11, 2019, was reviewed by TNC. Responses to comments received by November 28, 2019 on the public draft are provided as Appendix A of the GSP; however, responses to TNC's comments are not included. We reviewed the text of the Final GSP to determine if changes were made to the Final GSP text that addressed TNC's previously submitted comments. This attachment lists our original comments on the complete Public Draft GSP, as submitted during the public comment period, and states whether or not they were addressed in the Final GSP *[as green text in brackets]*. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 – Notice & Communication (23 CCR §354.10)

[Section 1.5.2 Description of Beneficial Uses and Users in the Basin (p. 9)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* We applaud the inclusion of environmental users in Section 1.5.2 and acknowledge the efforts of SWSD to use the TNC guidance and resources for identifying interconnected surface waters (ISWs) and groundwater dependent ecosystems (GDEs) throughout the GSP. **This section could be improved by making specific mention of GDE species and habitats, and specifically the Kern Wildlife Refuge and other protected lands, as beneficial users of groundwater.**

Checklist Items 2 to 4 - Description of Plan Area (23 CCR §354.8)

[Section 1.4.1 Plan Area Setting (p. 4)

- *[TNCs comment was partially addressed. Section 1.4.1 (p.4) has been revised and includes acreages of land use types including 8,960 acres associated with the Kern National wildlife Refuge and 69,500 acres of undeveloped native vegetation. Thank you for recognizing the riparian and native vegetation land uses. No changes were made to the text in Section 2.2.3.7.]* The SWSP GSP provides a description of the groundwater well types and well densities, and recognizes small water supply systems or domestic users that are groundwater dependent; however, there is no discussion in this section regarding environmental resources (e.g., wetlands, riparian areas, preserves, conservation areas) that may be groundwater dependent and any associated management requirements (flow, protection, monitoring). According to the NCCAG database, 26,973 acres are natural areas identified as potential groundwater dependent ecosystems (GDEs) based on wetland and/or vegetation.

[2] *Note: where appropriate, this document intends the terms "groundwater sustainability plan", "GSP" and "Plan" to refer to the Semitropic Water Storage District Management Area Plan (MAP), which is a component of the Kern Groundwater Authority GSP.*

Figure 1-2 presents large areas defined as riparian and native vegetation. **The riparian and native vegetation land uses should be formally recognized in Section 1.4.1, along with the recognition of their potential groundwater dependence. In addition, we suggest mentioning GDEs and ISWs as groundwater users of the shallow zone in Section 2.2.3.7.**

[Section 1.4.2 Existing Plans in Plan Area (pp. 4-6)]

- *[Our comments were not addressed and no changes to the GSP text were made.]* Under the general provisions of the Kern County General Plan, the County will "encourage the development of the County's groundwater supply to sustain and ensure water quality and quantity for existing users, planned growth, <u>and maintenance of the natural environment</u>" (emphasis added). However, implementation measures described in the plan are related to protection of groundwater quality, groundwater resources management, and demonstrating a long-term water supply. This section could be improved by providing a discussion of General Plan goals and policies related to the protection and management of wetlands, aquatic resources and riparian vegetation that could be affected by groundwater withdrawals. **Please consider adding a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs, if applicable.**
- *[Our comment was not addressed and no changes to the GSP text were made.]* Relevant Kern County General Plan goals and policies about future land use development and conservation complement the discussion of use and conservation of groundwater resource goals in the SWSP GSP. **This section could be further improved by also identifying Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin that may be associated with GDE or ISW habitats and addressing how GSP implementation will coordinate with the goals of these HCPs or NCCPs.**

[Section 1.4.3 Plan Elements from CWC Section 10727.4 (pp. 6-8)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* Section G Well Construction Policies (pp. 7-8) references the Kern County Public Health Services Department Water Well Program, which issues permits to construct water wells on a ministerial basis and without consideration of groundwater sustainability, such as the potential effects of the permitting and construction of new wells on aquifer systems, GDEs and ISWs.
    - **Please discuss how future well permitting and well construction will be coordinated with the GSP to assure achievement of the Plan's sustainability goals or indicate the need for this to be discussed with the County in the future.**
    - The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public

trust uses (ELF v. SWRCB and Siskiyou County, No. C083239). **Please include a discussion of the need for well permitting programs to comply with this requirement.**

- *[Our comment was not addressed and no changes to the GSP text were made.]* Section L Impacts on Groundwater Dependent Ecosystems (p. 8) states that "*there is the potential for Groundwater Dependent Ecosystems (GDE) in the western portion of the District and along Poso Creek. However, the presence of GDEs has not been verified*." Section 2.3.8 is referenced, but the conclusions summarized in that section are somewhat different and identify potential GSPs at various locations throughout the SWSP GSP area. **Please revise the conclusions in this section to be consistent with Section 2.3.8.**

Checklist Items 5 to 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 2.2.2 Lateral and Vertical Boundaries of Groundwater for SWSD (pp. 23-24)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* The bottom boundary of the Subbasin should be more precisely defined in accordance with DWR guidance. As noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions." Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom. This will prevent the possibility of extractors with wells deeper than the basin boundary (defined by the base of freshwater) from claiming exemption of SGMA due to their well residing outside the vertical extent of the basin boundary. **The vertical extent of the plan area could be better described by characterizing groundwater well extractions from the deepest wells in relation to defining the basin bottom**. If the bottom boundary of the Subbasin has not been clearly defined in certain management areas, **please identify this as a data gap.**

[Section 2.2.3 Principal Aquifers and Aquitards (pp. 25-39), Section 2.3 Current and Historical Groundwater Conditions (pp. 47-54)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* Figure 2-6 clearly outlines the general aquifer zones in the SWSD, and the text (pp. 26-27) provides a robust description of the shallow, upper unconfined and lower confined aquifers and principal aquitards (A-Clay and E-Clay). The hydrogeologic conceptual model is illustrated with an excellent series of maps and cross sections (Figures 2-1 through 2-29). The GSP reports depth to "usable" groundwater as greater than 60 feet, although the shallow zone ranges in depth from 5 to 20 feet below ground surface and may supply water to GDEs. As stated in Section 2.2.3 (p. 26), groundwater in the *shallow zone is likely the result of percolation from applied surface water for irrigation, as well as recharge from unlined conveyance, and managed application of surface water to the Kern National Wildlife Refuge*. The GSP cites Croft (1972) as a source of information regarding the A-Clay, which separates the shallow zone from the upper aquifer and is described as being generally less than 60 feet thick, but includes little data regarding the lateral continuity and variability of this aquitard. A type log in Croft (1972) shows a thickness of 5 feet, and it is described as consisting of a series of thin clay layers separated by sand at some locations. The SWSD GSP provides sufficient information to confirm that depth to groundwater contours of the shallow zone aquifer, which would be the zone hydrologically connected to ISWs and GDEs, have been stable over time, at least from 1995-2011. In addition, pumping in the lower aquifer does not appear to have adversely impacted groundwater in the upper aquifer or shallow zone. **This section could be improved by including additional discussion of the depth to groundwater more recently than 2011, the continuity, thickness and extent of the A-Clay relative to potential GDEs and ISWs, and the degree of interconnection between the shallow zone and the upper and lower aquifers, or by more clearly identifying any data gaps related to the shallow zone and the A-Clay, as appropriate.**

Checklist Items 8, 9 and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)

[Section 2.3.7 Interconnected Surface Water Systems (pp. 77-83)]

- *[Section 2.3.7 (p.117) was revised and incorrectly removed all ISWs. The text describes Poso Creek as "the only channel that experiences natural recharge;" however, the text goes on to state that Poso Creek is "ephemeral and only flows during limited wet periods," implying that because it is ephemeral it is not an ISW.]* The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted." "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. The text states (p. 77) that there are no known natural ISWs in the study area since flow in the Kern River was impounded and regulated and groundwater pumping began. Surface water bodies (shown on Figure 2-22) such as Jerry Slough and the Kern River Channel receive managed surface water deliveries, and the Kern National Wildlife Refuge is sustained by imported surface water. It is acknowledged that these systems, though sustained by surface water deliveries, may still be ISWs. The text (p. 77) further states that Poso Creek is the only surface water body that receives natural discharge from the surrounding highlands; however, the creek is ephemeral and only flows during limited "wet" months of some "wet" years. Please note however, that ephemeral flow does not mean that a stream is not an ISW. Additional analysis based on quantitative measurement data would be needed to conclusively determine whether natural ISWs exist in the GSP plan area. **Please provide additional data and analysis to establish whether natural ISWs are present in the plan area, or identify as a data gap to be addressed during plan implementation. In addition, this section would benefit from an additional discussion regarding the potential role of groundwater in the water balance for managed wetlands and recharge areas.**

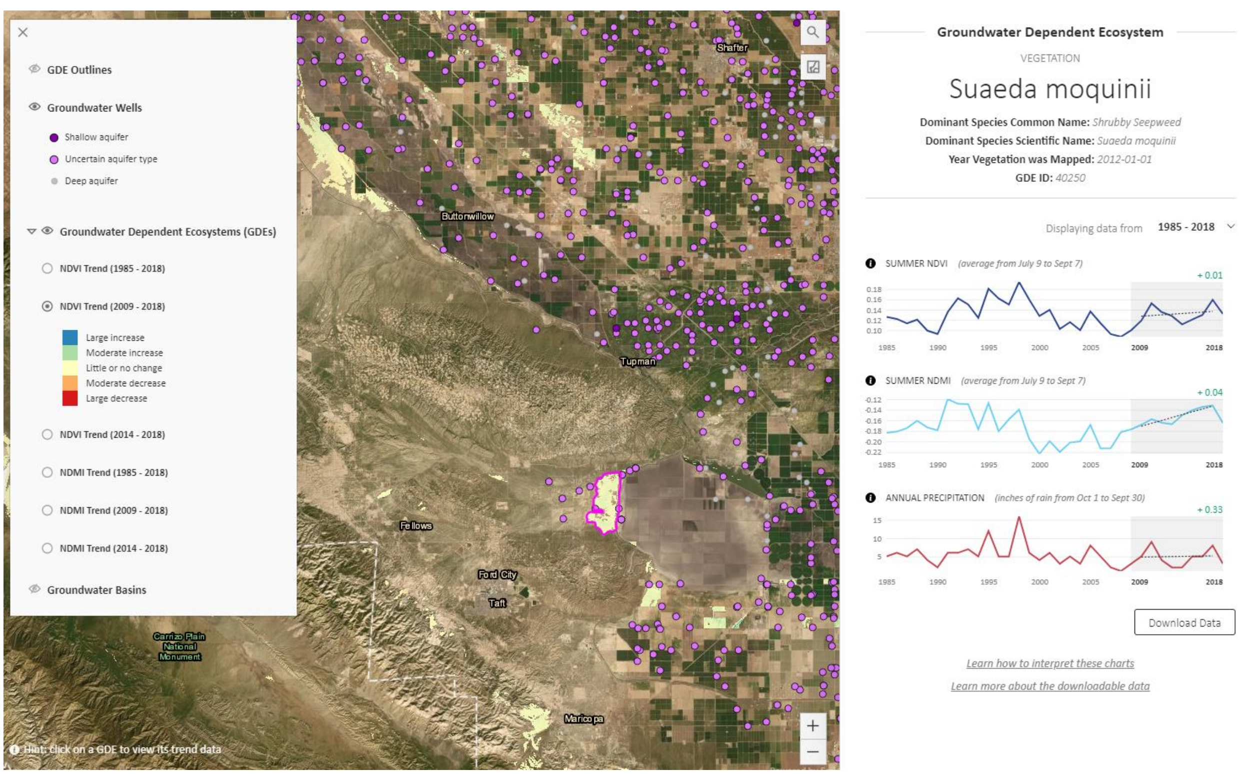
Checklist Items 11 to 20 – Identifying, Mapping and Describing GDEs (23 CCR §354.16)

[Section 2.3.8 Potential Groundwater-Dependent Ecosystems (pp. 77-83)]

- *[Steps outlined in Section 2.3.8.7 to address data gaps related to GDEs were incorporated as Management Action 6 to be completed by 2025. TNC applauds the inclusion of the evaluation and assessment of GDEs as a management action for the Semitropic Area.]* Section 2.3.8 and accompanying maps (Figures 2-31, 2-48 and 2-49), tables and subsections present a very thorough analysis of potential GDEs in the plan area. We applaud the thoroughness of the approach. The NCCAG database developed through a collaboration between DWR, California Department of Fish and Wildlife (CDFW) and TNC was used to identify potential GDEs, which were characterized in terms of the species present and their rooting depths (presented in Table 2-12, which was not included with the draft GSP). Both potential vegetation GDEs and potential wetland GDEs were identified and mapped (Figures 2-48 and 2-49, respectively, also not included with the draft GSP). The distribution of mapped GDE vegetation occurs in the natural lowlands associated with Jerry Slough and in the northwest along the Kern River Channel, just southwest of the Kern Natural Wildlife Refuge, along the Poso Creek Flood Channel (manmade), and in the north-central portion of SWSD. In addition, wetlands are mapped along the Kern River Channel and near Jerry Slough. The locations of these potential GDEs were then evaluated in terms of the depth to first groundwater, which was found to be approximately 5 to 20 feet, and groundwater elevation trends from 1995 to 2015. Groundwater level trends indicated stable shallow groundwater levels in some areas and declines during drought periods in other areas; however, it was generally not possible to determine if declines were related to groundwater pumping or climatic influences. Groundwater levels for deeper wells indicated continual saturated zones at several locations. The spatial distribution of potential GDEs was compared to identified land uses and GDEs were found to be proximal to drainages, riparian zones, recharge/managed wetland projects and agricultural lands. The work was acknowledged to be a preliminary analysis, and additional steps were suggested to confirm the location, nature and degree of groundwater dependence of the potential GDEs and their potential vulnerability to groundwater extraction. Suggested measures presented in Section 2.3.8.7 include field verification of mapped polygons, field verification of satellite-based land use data, additional monitoring of shallow groundwater to identify areas that are not linked to imported surface water from managed wetlands, and additional water level monitoring to evaluate the effects of pumping on shallow groundwater in the potential GDE areas. **The suggested steps in Section 2.3.8.7 present an excellent approach to address data gaps related to GDE identification, characterization and management, and a work plan for their implementation should be adopted as a management action in the GSP. The following additional factors should be considered:**
    - In the scientific literature, it is generally acknowledged that GDEs can rely on groundwater for some or all of their requirements. GDEs can rely on multiple water sources simultaneously and at different temporal and / or spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone,

groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow). Thus, the existence of a surface water source proximal to a potential GDE does not mean that it is not at least partially groundwater dependent and can suffer significant and unreasonable harm if groundwater levels decline;

- Section 2.3.8.3 asserts that SGMA would not be applicable to GDEs dependent on water in subterranean streams, which are regulated as surface water. This is only partially correct. SGMA regulates depletion of surface water that results in significant and unreasonable impacts to beneficial surface water uses. Groundwater extraction that depletes subterranean streams is thus subject to regulation under SGMA if it causes significant and unreasonable impacts to vegetation communities and associated habitats;
- Consideration should be given to using remote sensing data to assess the potential response of GDEs to groundwater level changes. Refer to GDE Pulse (https://gde.codefornature.org or Attachment E of this document) for an example of a tool that can be used to correlate depth to groundwater trends in and around GDE areas to trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in the basin.



Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)

[Section 2.4 Water Budget (pp. 83-86)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* In the section on natural recharge (p. 44), the SWSD GSP assumed that precipitation on land with native vegetation is consumptively used by natural vegetation; whereas, precipitation on agricultural properties is offset by irrigation. The GSP concluded that natural recharge by precipitation is minimal and may only occur in extreme wet years because evapotranspiration (ET) of crops exceeds the amount of natural precipitation to the Subbasin. The water budget (p. 85) included ET based on satellite remote sensing methodology as a water demand for developed agricultural lands ; however, the demand for undeveloped land was not included because the GSP assumed that ET is met by precipitation and not groundwater. A GDE would be a consumptive groundwater user, and its annual ET would exceed precipitation. The areas of natural vegetation where this condition applies can be readily determined from analysis of the remote sensing ET data and comparison to the NCCAG polygons. Depending on the results of an updated review of GDEs, groundwater ET and surface water demand to ET of GDEs should be identified as a groundwater budget component. **Please provide a breakdown of ET for native and riparian vegetation (such as wetlands, riparian vegetation, phreatophytes and other communities). Since potential GDEs (including wetlands, riparian vegetation, phreatophytes and other communities) are beneficial users of groundwater in the SWSD area, it is appropriate to include them in these calculations. Identify any data gaps and outline the actions needed to address them.**

Checklist Items 23 to 25 – Sustainability Goal (23 CCR §354.24)

[Section 3.1 Sustainability Goal (p.136)]

[Our comments were not addressed and no changes to the GSP text were made.] The sustainability goal of the SWSD GSP is the same as the Kern County Subbasin Umbrella GSP. It reiterates regulatory requirements and does not provide a description of the goal relative to the SWSD Plan Area setting and beneficial uses, mention environmental uses and users of groundwater or mention undesirable results. **Please expand the sustainability goal description for the SWSD Plan Area to ensure that all beneficial uses and users of groundwater, including GDEs and related critical habitats are protected from undesirable results.**

Checklist Item 26 – Measurable Objectives (23 CCR §354.30)

[Section 3.4 Measurable Objectives and Interim Milestones (pp. 145-148)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* Minimum thresholds and measurable objectives for chronic lowering of groundwater levels, reduction of groundwater storage and degraded water quality do not mention environmental beneficial users, such as GDEs. **For each of these applicable sustainable management criteria, please include a discussion of GDEs and whether the minimum thresholds, measurable objectives and interim**

milestones will help achieve the sustainability goal as it pertains to the environment.

- *[Our comment was not addressed and no changes to the GSP text were made.]* Section 2.3.7 states there are no natural ISWs; however, as stated in our comment on that section, managed ISWs can still be affected by groundwater withdrawals. In addition, the existence of natural ISWs along Poso Creek cannot be ruled out without more specific quantitative analysis. **Please provide a more thorough explanation of why managed ISWs may be eliminated from consideration in the development of sustainable management criteria. In addition, please include sustainable management criteria for natural ISWs along Poso Creek until/unless sufficient data are available to warrant elimination of this sustainability indicator under the SGMA regulations. If appropriate, please discuss measures proposed to address data gaps.**
- *[Our comment was not addressed and no changes to the GSP text were made.]* The degraded water quality measurable objective (p. 147) does not consider the water quality needs of GDEs. **Please modify Section 3.4.4 to include impacts from degraded water quality on the plant and wildlife communities within GDEs**.

<u>Checklist Item 27 to 29 – Minimum Thresholds (23 CCR §354.26c</u>)

[Section 3.3 Minimum Threshold (pp. 141-145)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* Similar to the above discussion, minimum thresholds for chronic groundwater level decline, storage depletion and groundwater quality do not consider GDEs, and minimum thresholds for depletion of ISWs are not developed. **Please include development of sustainable management criteria for GDEs and ISWs as discussed above.**

<u>Checklist Items 30 to 46 – Undesirable Results (23 CCR §354.26)</u>

[Section 3.2.1 Undesirable Results for Chronic Lowering of Groundwater Levels (pp. 137-138)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* This section describes undesirable results relating to human beneficial uses of groundwater (i.e., groundwater well dewatering and increased pumping lift) and does not discuss environmental beneficial uses / users that could be adversely affected by chronic groundwater level decline. The section indicates that groundwater levels in the upper aquifer are relatively stable, which would indicate that GDEs and ISWs are being managed sustainably under current and historical conditions and have not experienced significant and unreasonable impacts related to drawdown. **Please add "possible adverse impacts to potential GDEs and ISWs" to the list of potential undesirable results, and state that the available data indicate undesirable results related to these beneficial users have not occurred under current and historical management conditions.**

[Section 3.2.3 Undesirable Results for Degraded Groundwater Quality (pp. 139-140)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* This section discusses water quality with respect to agricultural use but does not include discussion of potential undesirable results for GDEs and ISWs. **Please modify this section to address the potential effects of degraded water quality on GDEs and ISWs.**

[Sections 3.2 Undesirable Results for Depletion of Interconnected Surface Water)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* Similar to the discussion of measurable objectives, interim milestones and minimum thresholds, a discussion of potential undesirable results is not included for the ISW depletion indicator. Additional data are needed before it can be concluded that natural ISWs are not present, and additional details are needed regarding the rationale for excluding managed ISWs from the development of sustainable management criteria is needed. **Please include development of sustainable management criteria for GDEs and ISWs as discussed above.**

Checklist Items 47-49 – Monitoring Network (23 CCR §354.34)

[Section 4.0 GSP Monitoring Network (pp. 152-177)]

- *[TNCs comment was not addressed. No additional monitoring of shallow groundwater above the A-Clay in the western part of the Subbasin is proposed and no changes to the GSP text were made.]* The GSP monitoring network design (p. 157) accounts for the three management areas established in this plan and shown on Figure 2-51: Buttonwillow Improvement District, Pond-Poso Improvement District and the Northwest Area, which contains some irrigated land but is mostly non-irrigated undeveloped land including the Kern National Wildlife Refuge. We applaud SWSD for including a management area specifically for nature! The network consists of 19 wells completed in the upper unconfined and lower confined aquifers. The text (p. 161) states that "*no pumping for beneficial uses occurs in the shallow zone and is classified as de minimis, consequently, the monitoring network does not include any monitoring of this zone*." Because the shallow zone is the groundwater-bearing unit that would most likely be connected to GDEs and ISWs and yield water to these beneficial users, the network should include monitoring wells completed in this zone. **We suggest modifying the well network to monitor the shallow zone near GDEs and ISWs. If suitable shallow monitoring wells cannot be located, this should be identified as a data gap and plans for the construction of shallow monitoring wells at key locations should be presented.**

Checklist Items 50 and 51 – Projects and Management Actions (23 CCR §354.44)

[Section 5.0 Projects and Management Actions (pp. 178-194)]

- *[We applaud Semitropic Water Storage District GSA for addressing data gaps related to GDEs. Table 5-1 (p.191) was revised and includes a new management action related to GDEs. Management Action 6 – Evaluation and Assessment of GDEs within the Semitropic Area, which will be completed by 2025, will conduct additional analyses to verify the presence and extent of GDEs within the Semitropic Area and to develop appropriate monitoring protocols to address GDEs, if present.]* Table 5-1 lists and Chapter 5 describes many planned or ongoing projects and management actions; however, the descriptions only identify benefits to water level, groundwater storage, water quality and water supply. Maintenance or recovery of groundwater levels and construction of recharge facilities may have potential environmental benefits. It would be advantageous to recognize these benefits so as to demonstrate multiple benefits from a funding and prioritization perspective. **For the projects already identified in Table 5-1, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue**. **Please describe how the projects and management actions will be evaluated to assess whether adverse impacts to GDEs may occur and/or will be mitigated or prevented. This information may help in the identification and prioritization of projects that are more likely to receive funding under grant programs that emphasize multiple benefits.**

Attachment C

Freshwater Species Located in the Kern County Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Kern County Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[3]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[4] as well as on TNC's science website[5].

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			

[3] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[4] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[5] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Dendrocygna bicolor	Fulvous Whistling-Duck		Special Concern	BSSC - First priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Lithobates pipiens	Northern Leopard Frog		Special Concern	ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS AND OTHERS				
Anax junius	Common Green Darner			
Argia emma	Emma's Dancer			
Argia lugens	Sooty Dancer			
Argia vivida	Vivid Dancer			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Enallagma cyathigerum				Not on any status lists
Erythemis collocata	Western Pondhawk			
Hetaerina americana	American Rubyspot			
Ischnura cervula	Pacific Forktail			
Libellula comanche	Comanche Skimmer			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Libellula forensis	Eight-spotted Skimmer			
Libellula saturata	Flame Skimmer			
Pachydiplax longipennis	Blue Dasher			
Paltothemis lineatipes	Red Rock Skimmer			
Pantala flavescens	Wandering Glider			
Pantala hymenaea	Spot-winged Glider			
Rhionaeschna multicolor	Blue-eyed Darner			
Sympetrum corruptum	Variegated Meadowhawk			
Tramea lacerata	Black Saddlebags			
Tramea onusta	Red Saddlebags			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Margaritifera falcata	Western Pearlshell		Special	
Physella virginea	Sunset Physa			Currently Stable
Planorbella traski	Keeled Rams-horn			X
PLANTS				
Alnus rhombifolia	White Alder			
Ammannia coccinea	Scarlet Ammannia			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla filiculoides	NA			
Baccharis glutinosa	NA			Not on any status lists
Baccharis salicina				Not on any status lists
Bacopa eisenii	Gila River Water-hyssop			
Berula erecta	Wild Parsnip			
Bidens laevis	Smooth Bur-marigold			
Bolboschoenus maritimus paludosus	NA			Not on any status lists

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Carex pellita	Woolly Sedge			
Castilleja minor minor	Alkali Indian-paintbrush			
Cephalanthus occidentalis	Common Buttonbush			
Chloropyron molle hispidum			Special	CRPR - 1B.1
Cicuta douglasii	Western Water-hemlock			
Cirsium crassicaule	Slough Thistle		Special	CRPR - 1B.1
Cotula coronopifolia	NA			
Cyperus erythrorhizos	Red-root Flatsedge			
Echinodorus berteroi	Upright Burhead			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis palustris	Creeping Spikerush			
Eleocharis parishii	Parish's Spikerush			
Eleocharis rostellata	Beaked Spikerush			
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Juncus textilis	Basket Rush			
Lasthenia ferrisiae	Ferris' Goldfields		Special	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Lasthenia glabrata coulteri	Coulter's Goldfields		Special	CRPR - 1B.1
Lemna gibba	Inflated Duckweed			
Lemna minor	Lesser Duckweed			
Lepidium oxycarpum	Sharp-pod Pepper-grass			
Ludwigia peploides peploides	NA			Not on any status lists
Lupinus polyphyllus burkei				Not on any status lists
Lycopus americanus	American Bugleweed			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Lythrum californicum	California Loosestrife			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus guttatus	Common Large Monkeyflower			
Myosurus minimus	NA			
Paspalum distichum	Joint Paspalum			
Perideridia pringlei	Pringle's Yampah		Special	CRPR - 4.3
Persicaria lapathifolia				Not on any status lists
Persicaria pensylvanica	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phacelia distans	NA			
Phalaris arundinacea	Reed Canarygrass			
Phyla nodiflora	Common Frog-fruit			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pluchea odorata odorata	Scented Conyza			
Pluchea sericea	Arrow-weed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus tenellus	NA			
Puccinellia simplex	Little Alkali Grass			
Rhododendron occidentale occidentale	Western Azalea			
Rorippa palustris palustris	Bog Yellowcress			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Rumex conglomeratus	NA			
Rumex salicifolius salicifolius	Willow Dock			
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus americanus	Three-square Bulrush			
Sesbania herbacea				Not on any status lists
Stachys albens	White-stem Hedge-nettle			
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	NA			
Zannichellia palustris	Horned Pondweed			
FISHES				
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Lampetra hubbsi	Kern brook lamprey		Special Concern	Vulnerable - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		Special	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		Special Concern	Near-Threatened - Moyle 2013
Mylopharodon conocephalus	Hardhead		Special Concern	Near-Threatened - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
Notes: ARSSC = At-Risk Species of Special Concern				

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
BCC = Bird of Conservation Concern BSSC = Bird Species of Special Concern CRPR = California Rare Plant Rank IUCN = International Union for Conservation of Nature SSC = Species of Special Concern				

Attachment D

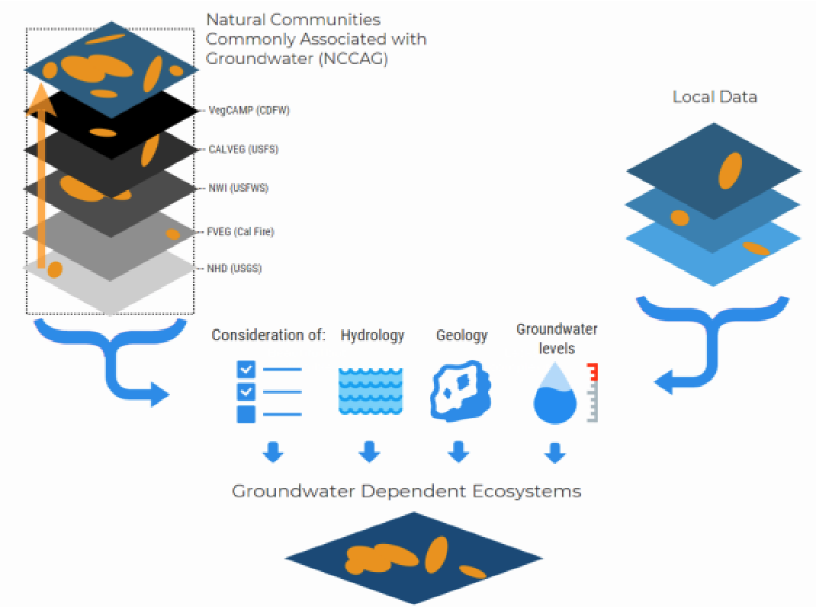
The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[6] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[7]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[6] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[7] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[8]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[9] on the Groundwater Resource Hub[10], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[8] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[9] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[10] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

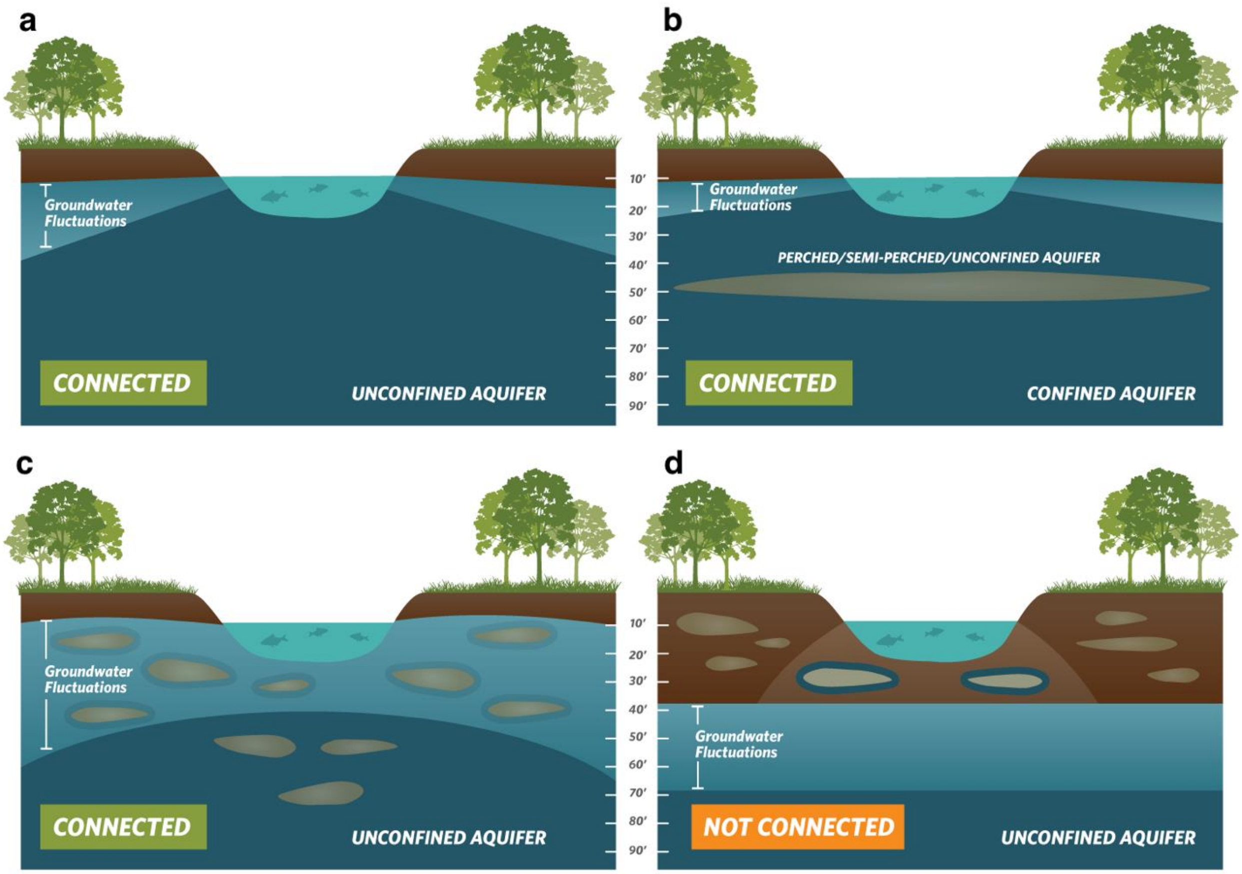

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[11] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[12] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[13] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[14]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

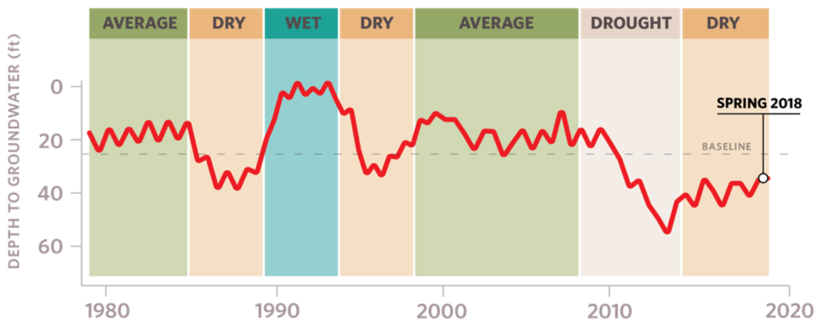

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[11] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[12] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[13] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[14] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[15], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

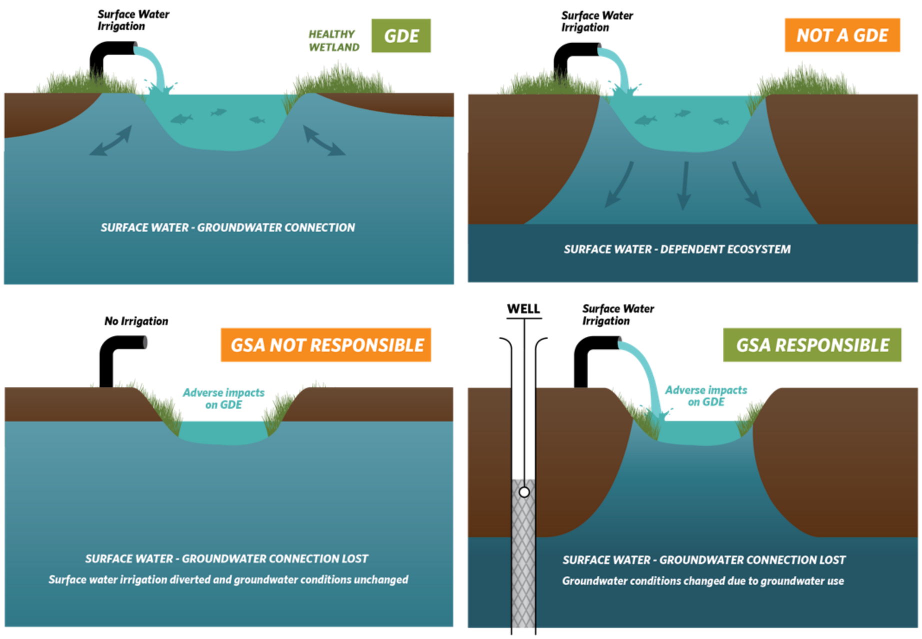

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[15] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

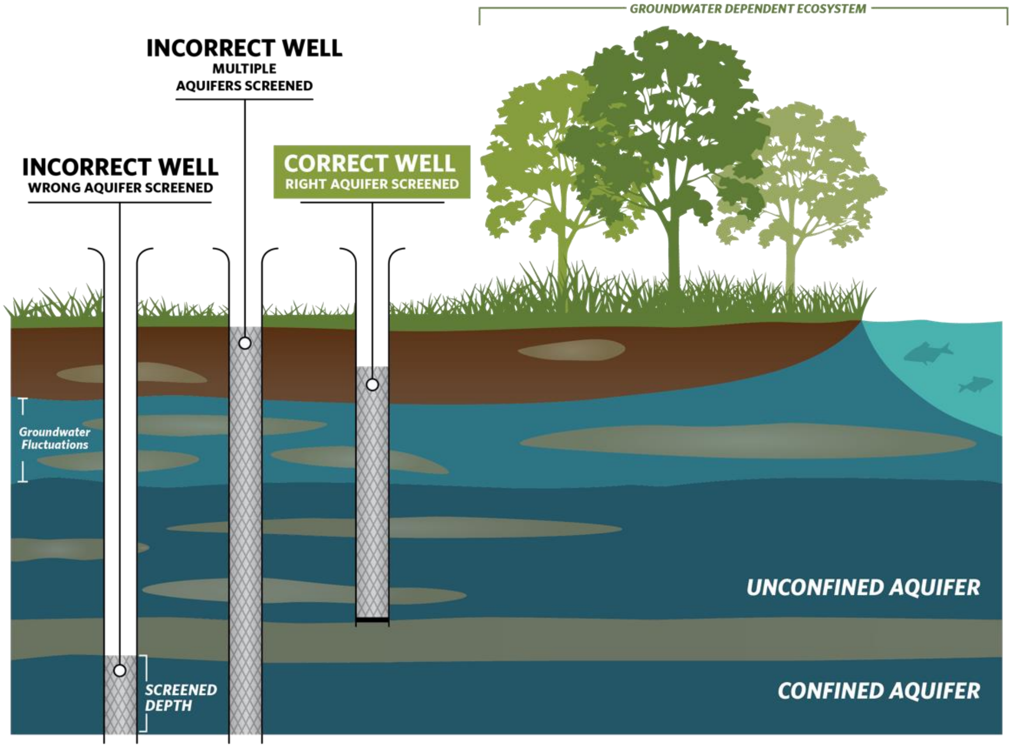

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[16] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

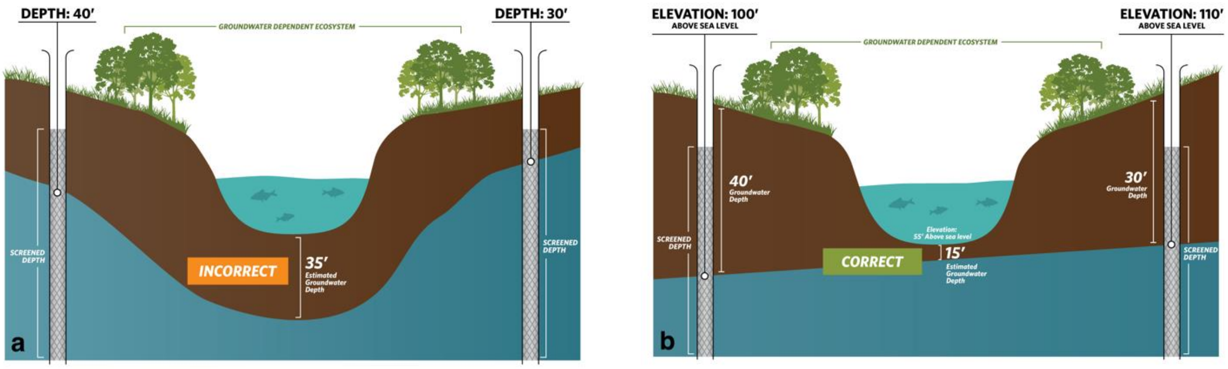

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

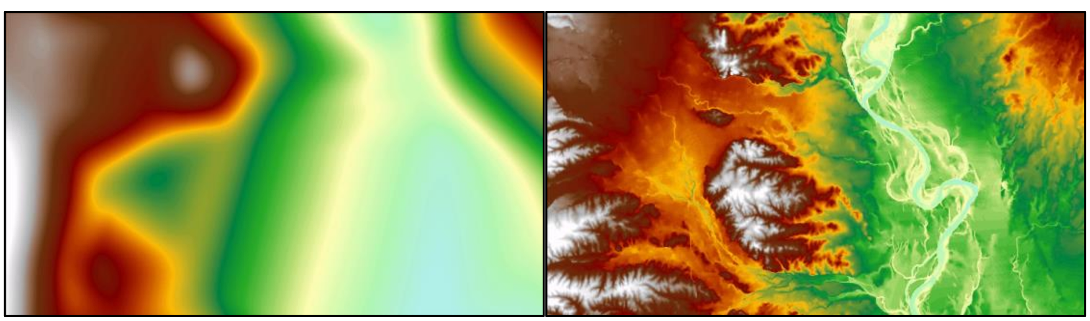

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[16] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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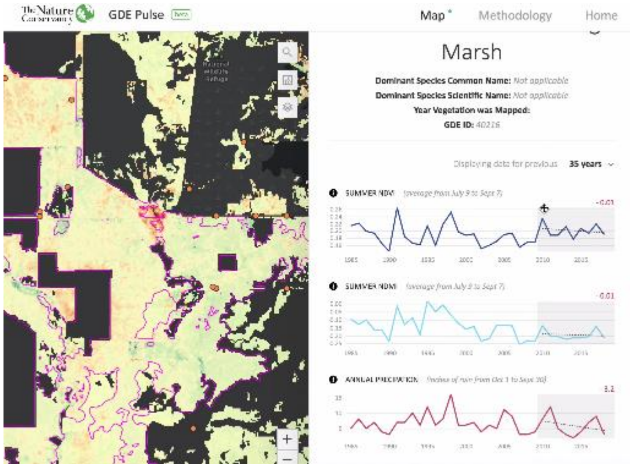
Protecting nature. Preserving life.

Visit
https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[17]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[18]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[17] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[18] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F

Mapping Likely Interconnected Surface Water

The Nature Conservancy, California, May 2020

Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, ISW is defined as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:

The groundwater elevation data, available for Spring 2011-2012, and Spring and Fall 2013-2018, comes from the California Department of Water Resources (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). These data are represented as continuous raster layers that approximates "feet above or below mean sea level" based on groundwater well measurements. According to the documentation online, groundwater level measurements were selected based on measurement date and well construction information (where available) and are intended to approximate the groundwater levels in the unconfined to uppermost semi-confined aquifers. Each of the raster layer has a different extent, but all of them are limited to the Central Valley. To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

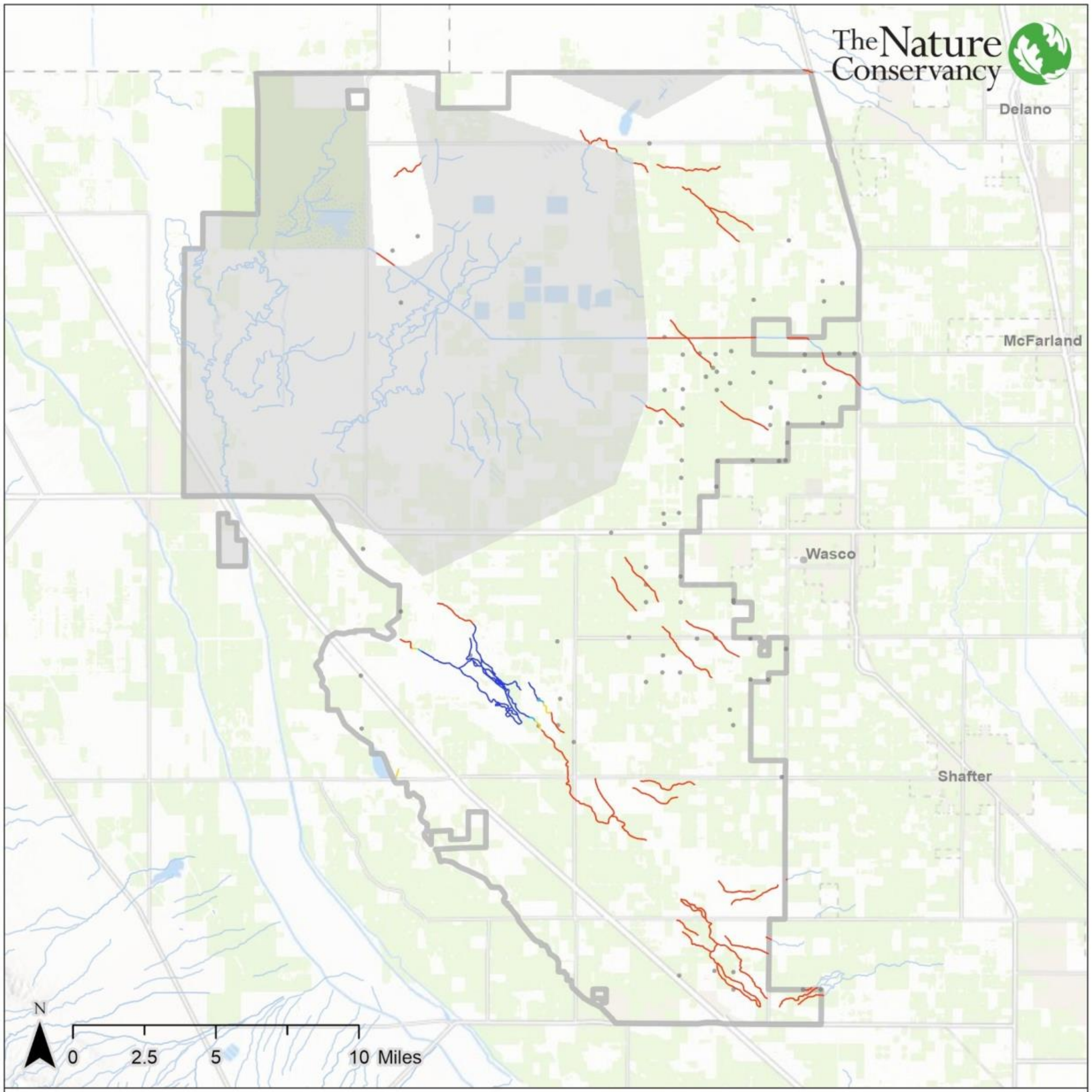
The map splits groundwater depth into four categories:

- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.
- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.

Interconnected Surface Water: Minimum Groundwater Depth (2011-2018)

Semitropic Water Storage District GSP



Legend

- Groundwater Sustainability Agency (GSA)
- No groundwater depth data available
- Groundwater Elevation Monitoring Point
- Rivers and streams with no depth data (120.3 miles)

Minimum Groundwater Depth

- Connected - Gaining: Groundwater at or above stream surface (16.3 miles)
- Connected - Losing: Groundwater within 20 feet of stream surface (0.5 miles)
- Uncertain*: Groundwater within 20-50 feet of stream surface (1.2 miles)
- Likely Disconnected*: Groundwater greater than 50 feet below stream surface (58.1 miles)

**Streams could be connected to riparian or perched aquifers or shallow aquifers that are poorly characterized. More data are needed to confirm disconnected status.*

Data Sources:
CA Dept. of Water Resources Groundwater Elevation Data, gis.water.ca.gov/app/gicima/
NHD Plus V2 Streams, nhdplus.com/NHDPlus/

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GroundwaterResourceHub.org

June 3, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Tri-County Water Authority Groundwater Sustainability Plan (GSP), Tule Subbasin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Tule Subbasin Groundwater Sustainability Agency's (GSA's) Tri-County Water Authority's Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing *sustainable* groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Tri-County Water Authority's GSP to be **significantly improved from the public draft version** and to be incomplete in addressing environmental beneficial uses and users. Note, this is an improvement from our assessment of the draft plan, which found the draft GSP to be insufficient in addressing environmental beneficial users.

While the GSP addressed environmental beneficial users in some respects, our review finds that portions of the GSP should be remedied before being approved. Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address gaps within 180 days. In these cases, we strongly recommend that the Department, at a minimum, set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. While Tri-County Water Authority GSA incorporated a portion of our feedback (8 of 44 comments were addressed), we disagree with the components where our feedback was ignored or dismissed. This suggests a limited degree of engagement of environmental beneficial users and could result in a definition of sustainability that is biased towards a limited set of users in the basin. In our experience, the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan," (23 CCR §355.4(b)(10).

TNC recommendation: We recommend that the GSA prioritize stakeholder engagement through improvements to the stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters – The GSP excluded potential and/or actual ISWs because the plan did not employ the best available science. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). The GSP acknowledges that water when present in the Tulare Lakebed may temporarily be in hydraulic connection with the underlying shallow groundwater, yet asserts that there is no indication that any of the streams or agricultural drainage water evaporation ponds in the area are in hydraulic connection with shallow groundwater. No monitoring data, analysis, or other information is provided to support this conclusion. Therefore, potential ISWs are not being managed in the GSP.

TNC recommendation: Until a disconnection can be proven, TNC recommends that the GSP include all potential and confirmed ISWs and prioritize the installation of additional shallow wells or nested monitoring wells or stream gauges at locations near high value or sensitive resources that are vulnerable to significant and unreasonable adverse impacts. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystems – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 7,371 acres of potential GDEs occur in the GSA boundary. The draft GSP indicated 3,516 acres of actual or potential GDEs and the final GSP identified 5,238 acres of actual or potential GDEs, which is a significant improvement. TNC developed the *Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs*[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

[1] Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

We would like to applaud the GSA for appropriately identifying and mapping vegetative and wetland GDEs using the NC Dataset, and for considering GDEs throughout the plan as a beneficial user of groundwater. Vegetation types and the occurrence of sensitive species were identified using the California Natural Diversity Database (CNDDB) and other tools and data gaps related to shallow groundwater were acknowledged in the Plan.

Water Budget – We were disappointed to see that the water budget did not include the current, historical and projected demands of native vegetation and/or managed wetlands, as required under SGMA (23 CCR §354.18(a) and (b)(3)). The GSP focused on agricultural users of groundwater, and evapotranspiration is only included as it pertains to crop water requirements. This is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget nor will they likely be considered in project and management actions.

TNC recommendation: As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

The Monitoring Network – While the monitoring network ensures partial coverage of sustainability indicators, the network should be improved to ensure adequate coverage of sustainability indicators, characterize the spatial and temporal exchanges between surface water and groundwater, and calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions required under SGMA (23 CCR §354.34(c)(6) and (f)(3). The monitoring network adequately monitors groundwater in the upper and lower aquifers; however, the network does not adequately monitor the shallow zone where environmental beneficial users would obtain groundwater or depletions in surface water. Because the shallow zone is the groundwater-bearing unit that would most likely be connected to GDEs and ISWs and yield water to these beneficial users, GDEs and ISWs are not being addressed in the GSP.

TNC recommendation: TNC recommends that the GSP: (1) modify the well network to monitor the shallow zone to detect GDE responses to groundwater level declines; (2) install additional stream gauges along Deer Creek and near the Tulare Lakebed where there is a potential for GDEs and ISWs to improve ISW mapping and inform the interconnectedness of streams and the Tulare Lakebed to shallow groundwater; and (3) determine what ecological monitoring can be used to assess potential impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but *sustainable* groundwater management that considers the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Tri-County Water Authority Groundwater Sustainability Plan

The Tri-County Water Authority's Groundwater Sustainability Plan (GSP), adopted as Resolution 19-06 by the Tri-County Water Authority Groundwater Sustainability Agency (GSA) on December 18, 2019, was reviewed by TNC. TNC submitted comments on the Public Draft GSP on November 7, 2019. However, responses to comments on the public draft were not publicly available so we compared the Public Draft GSP to the Final GSP to determine if changes were made to the Final GSP text that addressed TNC's previously submitted comments in the order of the checklist items included as Attachment A. This attachment lists our original comments on the complete Public Draft GSP, as submitted to the Tri-County Water Authority GSA during the public comment period, and states whether or not they were addressed in the Final GSP *[as green text in brackets].*

<u>Checklist Item 1 - Notice & Communication (23 CCR §354.10)</u>

[Section 1.5.1 Identification of Groundwater Beneficial Uses/Stakeholders (p. 52)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* California Water Code §1305(f) defines that beneficial uses of waters of the State include "preservation and enhancement of fish, wildlife, and other aquatic resources and preserves". Section 1.5.1 states the major use of groundwater is for agricultural irrigation. **Please describe the other beneficial uses and users of groundwater in the Subbasin, including: GDEs, managed wetlands, Protected Lands, including conservation areas and other protected lands, and Public Trust Uses including wildlife, aquatic habitat, fisheries and recreation.**
- *[Our comment was not addressed and no changes to the GSP text were made.]* The types and locations of environmental uses, species and habitats supported, and the designated beneficial environmental uses and users of surface waters that may be affected by groundwater extraction in the Subbasin should be specified. **Please explicitly identify any environmental uses and users of groundwater in the plan area, and take particular note of the species with protected status.** The following are resources that can be used:
    - Natural Communities Commonly Associated with Groundwater dataset (NC Dataset) - https://gis.water.ca.gov/app/NCDatasetViewer/
    - The list of freshwater species located in the Tule Subbasin in Attachment C of this letter.
    - The California Department of Fish and Wildlife's California Natural Diversity Database (CNDDB).

<u>Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8)</u>

[Section 1.4.1 Description of the Plan Area (pp. 3-50)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* The GSP provides a description of the Central Valley Project and groundwater well density, however there is no discussion of any instream flow requirements, if any, or how the water infrastructure is in compliance with regulatory requirements set to protect species of concern. **Please provide a description of any current and planned instream flow requirements for Deer Creek. If there are not instream flow requirements in place or planned, then please state that in the document.**

[Section 1.4.6 Land Use Elements or Topic Categories of Applicable General Plans (p. 29)]

- *[TNCs comments were addressed. Section 1.4.6-5 Impacts of Neighboring Land Use Plans has been revised and states that one of the goals of the GSP is to "minimize the loss of managed habitat, and to increase habitat areas in conjunction with recharge projects and storage facilities." Thank you for recognizing the environmental importance of habitat areas.]* This section is focused on agriculture and irrigation needs, demands, and types of irrigation. It briefly mentions the existence of a local gas field. It provides no description of the contents of the applicable county general plans and other land use and environmental plans that may contain information relevant to the GSP. We have the following specific comments.
    - **The sections of the County General Plans describing objectives and policies for water resources management, and management and protection of aquatic, riparian and wetland resources should be discussed in the GSP. Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs.**
    - This section should identify Habitat Conservation Plans (HCPs), Natural Community Conservation Plans (NCCPs) and management plans associated with wildlife refuges within and near the Plan area, and if they are associated with areas with instream flow requirements; or critical, GDE or ISW habitats. **Please identify all relevant HCPs and NCCPs within the Subbasin, and any reaches with instream flow and critical habitat requirements. Please elaborate on the natural resources within the Subbasin and address how GSP implementation will coordinate with the goals of these plans and requirements.**
    - The Critical Species Lookbook[2] includes the potential groundwater reliance of critical species in the basin. **Please include a discussion regarding the management of protected species and their habitats for these aquatic ecosystems and its relationship to the GSP.**
    - There are no figures that show the portions of the GSP area covered by city, community, and county general plans and other land management plans.

[2] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

Please include a figure that shows the areas covered by the general plans and other land use plans with which the GSP must be coordinated.

[Section 1.4.6-4 New/Replacement Wells Permitting Process (p. 30) and Section 1.4.7-10 Well Construction Policies (p. 35)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* Section 1.4.6-4 references the Tulare County well permitting program. Section 1.4.7.10 states that TCWA is developing well construction regulations that will restrict the construction of new lower aquifer wells in some areas and encourage the construction of upper aquifer wells instead, because it is considered more in balance; however, no details of this program are provided, and its potential impacts on the upper aquifer system, and of potential effects on GDEs and ISWs, are not discussed. **Please include a discussion of the following in this section:**
    - Additional details of the program, and how it will prevent potential adverse impacts to GDEs and ISWs, should be presented. If such details are not yet available, the plans and objectives for development of the program should be discussed under the chapter regarding projects and management actions in sufficient detail to demonstrate that GDEs and ISWs is being considered.
    - Please acknowledge that future well permitting must be coordinated with the GSP to assure achievement of the Plan's sustainability goals.
    - The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF v. SWRCB and Siskiyou County, No. C083239). **The need for well permitting programs to comply with this requirement should be stated in the text.**

Checklist Items 5 to 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 2.1.3 Basin Boundaries (p. 56)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* Defining the bottom of the Subbasin based on geochemical properties is a suitable approach for defining the base of freshwater, however, as noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** This will prevent the possibility of extractors with wells deeper than the basin boundary (defined by the base of freshwater) from claiming exemption of SGMA due to their well residing outside the vertical extent of the basin boundary. **Please characterize groundwater well extractions from the deepest wells in relation to defining the basin bottom**.

[Section 2.1.6 Cross Sections (pp. 68-80)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* Regional geologic cross sections are provided in Figures 2.1.4 through 2.1.10. These cross-sections do not include a graphical representation of the shallow groundwater-bearing zones that may be connected to GDEs and ISWs in the GSP area, and how they are connected to the upper aquifer system. **Please include example near-surface cross section details that depict the conceptual understanding of shallow groundwater and stream interactions at different locations, including the Shallow Zone, any perched aquifers, and the Upper Aquifer**.

[Section 2.1.4 Principal Aquifer and Aquitards (pp. 60 to 65)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* Although there is robust description of the aquifers there is no explicit description or supporting data and information of whether and how pumping in the lower aquifer influences the upper aquifer. On page 60 it is stated that groundwater above the A-clay, (upper aquifer) is generally not used for water supply; however, Section 2.1.4-5 (p 66) it states that there are two aquifers in the GSA and both are used for irrigation. DWR's definition of a principal aquifers are "aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems" [*23 CCR §351(aa)*]. Groundwater above the A-Clay in the upper aquifer may provide water supply to GDEs and ISWs.
    - **Please explicitly enumerate the principal aquifer(s) and intervening aquitards, their relationship to each other, and their role in supplying groundwater to all beneficial uses and users of groundwater (including environmental).**
    - **In addition, we request that the connectivity of GDEs and ISWs to each aquifer (including very shallow groundwater, where present) be made clear. If connectivity to a very shallow surficial aquifer exists, please establish its current and/or future management to determine if it is a principal aquifer. If it is a principal aquifer, it should be included in the sustainability goal and sustainability criteria. If it isn't a principal aquifer, please include text that states the future protection of GDEs would be incorporated into the 5-year update as future management plans are developed.**

[Section 2.2.1 Groundwater Elevation (pp. 94-100)]

- *[TNCs comment was not addressed. No additional maps were provided in the GSP.]* Groundwater elevation contours are shown for 2007 and 2010 on Figures 2.2.1, 2.2.2 (upper aquifer) and 2.2.3 and 2.2.4 (lower aquifer) with respect to mean sea level. Based on completion information, the wells used to contour groundwater levels in the upper aquifer do not necessarily monitor shallow groundwater that may be in communication with GDEs and ISWs. Depth to groundwater cannot be readily assessed from the maps. The latest groundwater levels provided are nearly 10 years old and predate the recent drought. **Please provide the following: 1)**

Groundwater level contour maps that are representative of historical as well as current conditions; 2) Groundwater level contour maps representative of the uppermost aquifer on which GDEs and ISWs may be reliant; and 3) Depth to water contour maps that allow interpretation of beneficial groundwater uses by environmental users.

[Section 2.2.4 Groundwater Quality (pp. 119-124)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* There is water quality information for the upper aquifer and a statement that there is pumping from the upper aquifer for dairy use, but there is no information regarding water quality in the upper aquifer to understand how water quality may affect GDEs. **Please modify this section of the GSP to include data about water quality in the zones where GDEs are present. If there is no data then please recognize this as a data gap and that additional data will need to be collected and analyzed.**

Checklist Items 8 to 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)

[Figure 2.1.14 Groundwater Discharge Areas (p. 90)]

- *[TNCs comment was not addressed. No changes were made to this figure in the GSP.]* Figure 2.1.14 shows only the locations of pumping wells, and does not include areas where groundwater discharge may be occurring through phreatophytes or other GDEs. **Please include the locations of phreatophytes and other GDEs to provide a complete representation of all groundwater discharge areas. If the regional groundwater connection of phreatophytes and other GDEs is not known, please identify this data gap, provide an approach to address it, and include the GDEs as potential GDEs on the figure until they can be more conclusively evaluated.**

[Section 2.2.6 Interconnected Surface Water Systems (p. 124)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. ISWs can be either gaining or losing. The defining feature of disconnected surface waters is that groundwater is consistently below surface water features such that an unsaturated zone always separates surface water from groundwater, not whether the reach is gaining or losing. The text states (p. 124) that "There is no indication that any of the streams in the GSA are in hydraulic connection with the shallow groundwater. However, when the Tulare Lakebed contains lake water, this water may temporarily be in hydraulic connection with the underlying shallow groundwater at some locations." No monitoring data, analysis, or other information is provided to support this important conclusion, as such, the statement that “there is no indication” could in fact mean that the conclusion is based on the existence of a data gap. **Please provide data or analysis to document the statement. Please identify data gaps (e.g., lack of shallow or nested/clustered monitoring wells or stream gauges) and either reconcile them or provide a plan to address them as needed to improve identification of ISWs prior to disregarding them in the GSP.**

Checklist Items 11 to 15 – Identifying and Mapping GDEs (23 CCR §354.16)

[Section 1.4.7-12 Groundwater Dependent Ecosystems (pp. 36-42) and Section 2.2.7 Groundwater Dependent Ecosystems (p. 125)]

- *[TNC applauds Tri-County Water Authority for using the NCCAG dataset and other available tools to identify and map GDEs. The text regarding impacts of water supply and management practices on GDEs and identifying and mapping GDEs in Sections 1.4.7-12 and 2.2.7 have been revised to acknowledge data gaps related to shallow groundwater.]* The text acknowledges the potential for GDEs in both management areas; however, there is no documentation regarding the depth to groundwater in the areas near the GDEs.
    - While depth to groundwater levels within 30 feet are generally accepted as being a proxy for deciding if polygons in the NC dataset are connected to groundwater, seasonal and interannual groundwater fluctuations in the groundwater regime must be taken into consideration. Utilizing groundwater data from one point in time (e.g., Winter 2014 to 2015, during the height of the recent drought) can misrepresent groundwater levels near GDEs and whether groundwater is available to meet their water requirements, and result in adverse impacts to the GDEs. Based on a study we recently submitted to *Frontiers in Environmental Science*, we've observed riparian forests along the Cosumnes River to experience a range in groundwater levels between 1.5 and 75 feet over seasonal and interannual timescales. Seasonal fluctuations in the regional water table can support perched groundwater near an intermittent river that seasonally runs dry due to such fluctuations. While truly perched groundwater itself cannot directly be managed due to its isolation in the vadose zone, the water table position within a continuous saturated zone connected to the upper regional aquifer can and should be monitored and managed. **Depth to groundwater maps should be included in the GSP for the uppermost shallow groundwater system, unless conclusively determined to be perched. We highly recommend using depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons to support determination whether or not they are groundwater-dependent. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset seasonally and interannually, or to determine**

conclusively whether shallow groundwater is hydraulically connected to underlying aquifers, include those polygons in the GSP until data gaps are reconciled in the monitoring network, and include specific measures and time tables to address the data gaps.

- *[TNCs comment was addressed. The text has been revised and data gaps related to shallow groundwater are acknowledged in Section 1.4.7-12. Thank you for addressing TNCs comment regarding identification of data gaps.]* If there are insufficient groundwater level data in the upper aquifer and overlying shallow groundwater zones, then the NCCAGs in these areas should be included as GDEs in the GSP until data gaps are reconciled in the monitoring network. **Confirmation of GDEs should be based on depth to groundwater in the Shallow Zone. Please revise the GDE analysis in the GSP to include a complete analysis and identification of data gaps.**
- *[TNCs comment was not addressed. No depth to shallow groundwater contour maps were included.]* **Please provide depth to groundwater contour maps and note the following best practices for doing so.**
  - Are the wells used for interpolating depth to groundwater sufficiently close (<5km) to NC Dataset polygons to reflect local conditions relevant to ecosystems?
  - Are the wells used for interpolating depth to groundwater screened within the surficial unconfined aquifer and capable of measuring the true water table?
  - Is depth to groundwater contoured using groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape? This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide much more accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make. It is better to assume that water surface elevations are constant in between wells, and then calculate depth to groundwater using a DEM of the land surface to contour depth to groundwater.
- *[TNCs comment was addressed. The text has been revised and vegetation types were identified using the CNDDB. No GDEs were eliminated from the vegetative GDE; wetland GDE maps in Figures 1.4.9-A and 1.4.9-B are based on rooting depth. Thank you for using the CNDDB to identify vegetation types in GDEs.]* Groundwater requirements of GDEs vary with vegetation types and rooting depths. In identifying GDEs, care should be taken to consider rooting depths of vegetation. **Please indicate what vegetation is present in the possible GDEs, and whether the GDE was eliminated or retained based solely on the 30-foot depth limit.** While Valley Oak (*Quercus lobata*) have been observed to have a maximum rooting depth of ~24 feet (https://groundwaterresourcehub.org/gde-tools/gde-rooting-depths-

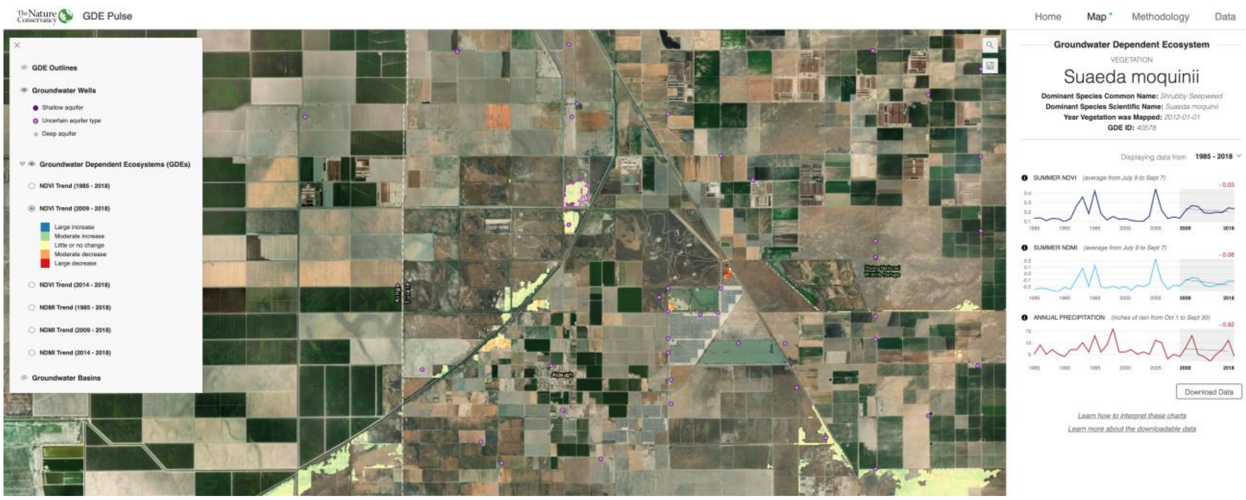
database-for-gdes/), rooting depths are likely to spatially vary based on the local hydrologic conditions available to the plant. Also, maximum rooting depths do not take capillary action into consideration, which will vary with soil type and is an important consideration since woody phreatophytes generally do not prefer to have their roots submerged in groundwater for extended periods of time, and hence effectively redistribute their root systems to straddle the water table as it fluctuates. Hence, this species is highly capable of accessing groundwater at much deeper depths when needed.

- *[TNCs comment was partially addressed. The text in Sections 1.4.7-12 and 2.2.7 has been revised. However, no shallow groundwater contour maps were included to identify whether a connection to groundwater exists.]* In the scientific literature, it is generally acknowledged that GDEs can rely on groundwater for some or all of their requirements. GDEs can rely on multiple water sources simultaneously and at different temporal and / or spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow), and yet still require groundwater in order to remain viable and healthy. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface". The operative consideration in this definition is dependence, not exclusive dependence or continuous connection. **Hence, we recommend using depth to groundwater contour maps derived from subtracting groundwater levels from a DEM, as described above, to identify whether a connection to groundwater exists for the GDEs presented in Figure 1.4.9 in the Subbasin. Please refer to Attachments D and E of this letter for best practices for using local groundwater data to 1) verify whether polygons in the NC Dataset are supported by groundwater in an aquifer, and 2) verify ecosystem decline or recovery is correlated with groundwater levels.**

Checklist Items 16 to 20, Describing GDEs (23 CCR §354.16)

[Section 1.4.7-12 Groundwater Dependent Ecosystems (pp. 36-42) and Section 2.2.7 Groundwater Dependent Ecosystems (p. 125)]

- *[TNC applauds Tri-County Water Authority for using GDE Pulse and other tools available to describe GDEs.]* **Please provide information on the historical and current groundwater conditions near the GDEs or the ecological conditions present during these times**. Refer to GDE Pulse (https://gde.codefornature.org; See Attachment E of this letter for more details) or any other locally available data (e.g., leaf area index, evapotranspiration or other data) to describe depth to groundwater trends in and around GDE areas, and how they relate to trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in the Tri-County Water Authority.



- *[TNC commends Tri-County Water Authority for using the CNDDB and other tools available to describe GDEs including vegetation or habitat types shown on Figure 1.4.9-C.]* **Please provide an ecological inventory for all potential GDEs (see Appendix III, Worksheet 2 of the GDE Guidance) that includes vegetation or habitat types and ranks the GDEs as having a high, moderate or low value. Explain how each rank was characterized.**
- *[TNC applauds Tri-County Water Authority for using CNDDB and other tools available to identify the occurrence of sensitive species shown on Figure 1.4.9-D.]* **Please identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat have been identified in or near any of the GDEs. Note that some organisms rely on uplands and wetlands during different stages of their lifecycle**. Resources for this include the list of freshwater species located in the Subbasin that can be found in Attachment C of this letter, the Critical Species Lookbook, and CDFW's CNDDB database.

Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)

[Section 2.3 Water Budget (pp. 126-174)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* Evapotranspiration is included as category in the groundwater balances (Table 2.3.8); however, it is only included as it pertains to crop water requirements. Groundwater outflow to ET should be identified as a groundwater budget component. If the outflow is not known, it should be identified as a data gap and provisional information should be provided until an analysis can be performed to address the data gap. **Please provide a breakdown of ET for all land-cover types, including environmental beneficial users like native and riparian vegetation (wetlands, phreatophytes and other communities). Identify any data gaps and outline the actions needed to address them and the schedule for their implementation.**

[Section 2.4.3 Monitoring and Analysis (p. 178)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* Data Gaps (p. 179). This section includes a statement that recognizes data gaps particularly in the upper aquifer; however, the explanation of this data gap does not include a lack of temporal and spatial information for the monitoring, assessment and management of potential impacts to GDEs and ISWs, which are beneficial users of groundwater. **Please update the data gaps section, where appropriate, for both management areas to acknowledge the lack of detailed information on shallow groundwater in the upper aquifer, and its relationship to GDEs.**

Checklist Item 23-26 Sustainability Goal (23 CCR §354.24)

[Section 3.1 Sustainable Groundwater Management Criteria (p. 182)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* **Since GDEs and ISWs may be present in and near the GSP area (please see comments under Checklist Items 16-20) they should be explicitly recognized in the establishment of sustainable management criteria for the groundwater level decline and ISW sustainability indicators. Please also update this section to recognize environmental beneficial groundwater uses as a component of the sustainable management goals.**

[Section 3.2 Sustainability Goal (p. 183)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* The Sustainability Goal states that "The goal of the TCWA is the absence of significant and unreasonable undesirable results associated with groundwater pumping in TCWA, accomplished by 2040". Although this is followed by additional text on beneficial uses the overall theme is to protect groundwater resources for developed water users. **The narrative discussion of the sustainability goal should be expanded to include the environmental uses and users of groundwater.**
  - *[Our comment was not addressed and no changes to the GSP text were made.]* **Since GDEs and ISWs may be present in the Subbasin (please see comments under Checklist Items 16-20) they should be recognized as beneficial users of groundwater and should be included in the Sustainability Goal. In addition, a statement about any intention to address pre-SGMA impacts should be included.**
  - *[Our comment was not addressed and no changes to the GSP text were made.]* The GSP states that there is no ISW connectivity for Deer Creek; however, there isn't any quantitative analysis, monitoring data, or other information provided to support this conclusion. **Please include ISWs in the Sustainability Goal until sufficient data is available to conclude the status of ISWs.**
  - *[Our comment was not addressed and no changes to the GSP text were made.]* GDEs are dependent, in part, on suitable water quality; however, the GSP only considers water quality for irrigation and domestic use. **Given that there are potential GDEs in the Subbasin, and they may be affected by water quality they should be included in the Sustainability Goal and addressed**

in the Sustainable Management Criteria established for the Water Quality Sustainability Indicator.

Checklist Item 26 – Measurable Objectives (23 CCR §354.30)

[Section 3.5 Measurable Objectives (pp. 212-214)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* This Measurable Objective for chronic decline in groundwater levels does not consider GDEs. **Please include GDEs (see comments under checklist items 16-20) in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to environmental beneficial users.**
- *[Our comment was not addressed and no changes to the GSP text were made.]* This GSP states that there are no ISWs in Deer Creek; however, the GSP provides no data or analysis to support this conclusion. In addition, Tule Lake is identified as potentially being groundwater connected during some periods. **Please modify this section of the GSP to include a statement that recognizes the potential for ISWs, pending the characterization of the upper aquifer and analysis of monitoring data or monitoring from additional wells to be installed in the future to address data gaps.**
- *[Our comment was not addressed and no changes to the GSP text were made.]* This water quality Measurable Objective does not consider the water quality needs of GDEs. **Please modify this section to include impacts from degraded water quality on the plant and wildlife communities within GDEs**.
- *[Our comment was not addressed and no changes to the GSP text were made.]* Section 2.2.6 states (p 116) that there may be a temporary connection between surface water the upper aquifer system in the Tulare Lakebed. Many of the wells are screened deeper and nested wells have not been installed to inform how shallow groundwater interacts with potential ISWs and GDEs, and there are no data or analyses presented that would allow the potential for ISWs and GDEs to be dismissed. **Based on this information, the GSP should acknowledge the potential for ISWs and GDEs and establish Measurable Objectives for this indicator. Please include all potential ISWs and GDEs in the analysis and develop measurable objectives and minimum thresholds, to be managed until data gaps prove they are not interconnected. Please identify any data gaps for future resolution.**

Checklist Item 27-29 – Minimum Thresholds (23 CCR §354.26c)

[Section 3.3.3 Evaluation of Minimum Thresholds (pp. 189-208) and Section 3.4 Minimum Thresholds (pp. 209-211)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* The evaluation of minimum thresholds disregards consideration of environmental beneficial users, such as ISWs or GDEs. **Although there are many data gaps associated with ISWs and GDEs, it must be assumed that potential significant and unreasonable impacts to these beneficial users could occur.**

As such, they should be addressed in the evaluation of minimum thresholds. Section 3.3.3 should be modified to address how potential ISWs and GDEs would be affected by further lowering of groundwater levels.

- *[Our comment was not addressed and no changes to the GSP text were made.]* Section 3.3.3 states that development of minimum thresholds for interconnected surface water is not applicable, but fails to provide any monitoring data, analysis or other information to substantiate this position. The GSP identifies groundwater levels in the upper aquifer as a data gap and indicates that Tule Lake may sometimes be hydraulically connected to the regional aquifer system. Minimum thresholds must be established for ISWs and GDEs unless and until sufficient data are provided to eliminate them from consideration. **Please modify this section of the GSP to 1) develop minimum thresholds for possible ISWs, including GDEs, and 2) include a statement that a data gap exists related to the interconnectedness of the of the Lakebed and shallow groundwater as well as Deer Creek.**
- *[Our comment was not addressed and no changes to the GSP text were made.]* Section 3.3.3 and 3.4 does not include the required analysis of how the selected minimum thresholds for decline in groundwater levels could affect ISWs and GDEs within and near the GSP area. **Please include an analysis of the potential effect of the established minimum thresholds on ISWs and GDES within and near the GSP area.**
- *[Our comment was not addressed and no changes to the GSP text were made.* Although agricultural and domestic water quality concerns were articulated, similar concerns were not identified for environmental users. Degradation of water quality can impact terrestrial and aquatic wildlife that live in or near these ecosystems during at least part of the year even if the water is not a concern from an agricultural or municipal standpoint. **Please include a discussion about GDEs and water quality and whether the minimum thresholds and interim milestones will help achieve sustainability for environmental users.**

Checklist Item 30-36 – Undesirable Results (23 CCR §354.26)

[Section 3.2.2 Undesirable Results (for chronic lowering of groundwater levels) (pp. 185-187)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* This section only describes undesirable results relating to human beneficial uses of groundwater and neglects environmental beneficial uses / users that could be adversely affected by chronic groundwater level decline or depletion of interconnected surface waters. **Please add "possible adverse impacts to potential GDEs and ISWs" to the list of potential undesirable results.**
  - *[Our comment was not addressed and no changes to the GSP text were made.]* The GDE Pulse web application developed by TNC provides easy access to 35 years of satellite data to view trends of vegetation metrics, groundwater depth (where available), and precipitation data. This satellite imagery can be used to observe trends for NC dataset polygons within and near the GSA. Over the past 10 years (2009-2018), some NC dataset vegetation polygons have experienced adverse impacts to vegetation growth and moisture. An example screen shot of

GDEs near Huron, California from the GDE Pulse tool is presented under Checklist items 11-15 above.

- **For each potential GDE unit with supporting hydrological datasets please include the following:**
    - Plot and provide hydrological datasets for each GDE.
    - Define the baseline period in the hydrologic data.
    - Classify GDE units as having high, moderate, or low susceptibility to changes in groundwater.
    - Explore cause-and-effect relationships between groundwater changes and GDEs.
- **For each identifiable GDE unit without supporting hydrological datasets please describe data gaps and / or insufficiencies.**
- **Compile and synthesize biological data for each GDE unit by:**
    - Characterizing biological resources for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.
    - Describing data gaps / insufficiencies.
- **Describe possible effects on potential ISWs, GDEs, land uses, and property interests, including:**
    - Cause-and-effect relationships between potential ISWs and GDEs with groundwater conditions.
    - Impacts to potential ISWs and GDEs that are considered to be "significant and unreasonable."
    - Report known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities.
    - Land uses should include recreational uses (e.g., fishing/hunting, hiking, boating).
    - Property interests should include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.

[Section 3.3 Undesirable Results (for degraded groundwater quality) (pp. 185-187)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* This section discusses water quality with respect to agricultural and municipal use but does not include discussion of potential undesirable results for GDEs and ISWs. **Please modify this section to specifically address degraded water quality from TDS and B to the vegetative portion of GDEs and ISWs. Although As is mentioned in this GSP please consider adding a statement that over-pumping and dewatering of aquitards has been identified as a potential source of elevated As concentrations above drinking water standards in San Joaquin Valley aquifers.** The following is a link to a paper by Smith, Knight and Fendorf (2018) titled "Overpumping leads to California groundwater arsenic threat": https://www.nature.com/articles/s41467-018-04475-3

[Sections 3.3 Undesirable Results (for depletion of interconnected surface water) (p. 207 not discussed)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* The GSP states that there are no ISWs; however, there is no monitoring data, analyses or other information to support this conclusion. In addition, Section 2.2.6 indicates a connection may sometimes exist between shallow groundwater and Tulare Lake. Furthermore, GDEs may exist within and near the GSP area. A data gap needs to be identified and a monitoring network employed to verify the status of ISWs prior to complete dismissal of ISWs from the GSP. **Please modify this section of the GSP to include 1) an assessment of the nature of potential undesirable results to ISWs and GDEs; 2) recognition of the existence of potential ISWs and GDEs, unless adequate data can be provided to dismiss them, 3) a statement that the aquifers will be managed such there will be no depletion of ISWs that results in a significant and unreasonable impact to GDEs; and 4) recognition of any data gaps and specific steps to verify the presence or absence of ISWs and GDEs with monitoring wells screened at the appropriate depths.**

Checklist Item 37-46 – Undesirable Results (23 CCR §354.26)

- *[Our comment was not addressed and no changes to the GSP text were made.]* Biological data should be compiled and synthesized for each GDE unit. **Based on the potential for GDEs in the Subbasin please include:**
    - Characterization of biological resources for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.
    - A description of data gaps / insufficiencies.
    - Stated plans to reconcile data gaps in the monitoring network.
- **Describe the following potential effects on GDEs, land uses and property interests:**
    - Cause-and-effect relationships between GDE and groundwater conditions.
    - Impacts to GDEs that are considered to be "significant and unreasonable".
    - Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities.
    - Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).
    - Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.
- **Define any data gaps in the above requests and develop a plan to address them.**

Checklist Items 47-49 – Monitoring Network (23 CCR §354.34)

[Chapter 4 Monitoring Network (p. 220)]

- *[Our comment was not addressed and no changes to the GSP text were made.]* The GSP proposes to use groundwater level monitoring to assess potential groundwater level declines. A set of representative wells has been selected to monitor the upper and lower aquifer (Tables 3.4.1 and 3.5.1). However, there are no plans to monitor groundwater level declines to assess the potential for significant and unreasonable impacts to GDEs or ISWs. In addition, the monitoring wells are not screened in the upper portion of the upper aquifer, where environmental beneficial users would obtain the groundwater on which they rely. Finally, there are no plans to monitor potential depletions in surface water flows or to assess potential GDE responses to groundwater level declines **Please modify the description of the new well network to provide methodologies, data and other information to support the monitoring of GDEs and ISWs so as to assess and prevent potential significant and unreasonable impacts. This modification should include 1) locating new wells that are appropriately screened to detect connectivity of GDEs and ISWs with the upper aquifer and 2) identifying or installing additional stream gages in areas where there is potential for ISWs and GDEs. In addition, monitoring or GDE responses to groundwater level declines should be included. GDE Pulse represents an example of how remote sensing can be used to achieve this objective. Please expand on the discussion of how the new well, stream and other data will be used to improve ISW mapping and inform an adequate analysis, and how the data will be used to verify possible GDEs and their sensitivity to groundwater level declines.**
- *[Our comment was not addressed and no changes to the GSP text were made.]* As stated above in the comments for Checklist Items 8-10, **please reconcile data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells, GDE responses to groundwater levels) along Deer Creek in this section of the GSP to improve ISW mapping in future GSPs**.

<u>Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)</u>

[Chapter 5 Projects and Management Actions (pp. 267-297]

- *[Our comment was not addressed and no changes to the GSP text were made.]* This chapter identifies many important projects; however, the descriptions of Measurable Objectives for these projects only identifies benefits to water level and storage through changes in allocation, imports, surface water diversions, and pumping allowances, and adding percolation basin. Since maintenance or recovery of groundwater levels, or construction of recharge facilities, may have potential environmental benefits it would be advantageous to demonstrate multiple benefits from a funding and prioritization perspective.
    - **For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.**

- If ISWs will not be adequately protected by those listed, **please include and describe additional management actions and projects targeted for protecting ISWs.**
- The storage projects, such as identified as White Ranch/ Deer Creek Project (p 285) and Liberty Ranch (p 286) can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such facilities have been incorporated into local HCPs and NCCPs, more fully recognizing the value of the habitat that they provide and the species they support. For projects that construct recharge ponds, **please consider identifying if there is habitat value incorporated into the design and how the recharge ponds can be managed as multiple-benefit projects to benefit environmental users. Grant and funding opportunities for SGMA-related work may be available for multi-benefit projects that can address water quantity as well as provide environmental benefits. Please include environmental benefits and multiple benefits as criteria for assessing project priorities.**
- For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

* *[Our comment was not addressed and no changes to the GSP text were made.]*
This chapter should identify the specific actions and schedules proposed to address data gaps in the hydrogeologic conceptual model, water budget and monitoring network.

Attachment C

Freshwater Species Located in the Tule Lake Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located within the Tule Lake Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[3]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[4] as well as on TNC's science website[5].

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	BCC	SSC	BSSC - First priority, BLM
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		SSC	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya valisineria	Canvasback		SSC	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			

[3] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[4] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[5] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		SSC	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus buccinator	Trumpeter Swan			
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	BCC	SSC	BSSC - Third priority
Dendrocygna bicolor	Fulvous Whistling-Duck		SSC	BSSC - First priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	BCC	Endangered	USFS
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	BCC	Endangered	USFS, BLM
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		SSC	BSSC - Third priority
Ixobrychus exilis hesperis	Western Least Bittern		SSC	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		SSC	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Vireo bellii	Bell's Vireo			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		SSC	BSSC - Third priority
CRUSTACEANS				
Branchinecta lindahli	Versatile Fairy Shrimp			
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	SSC	IUCN - Vulnerable
Branchinecta mackini	Alkali Fairy Shrimp			
Hyalella azteca	An Amphipod			
Hyalella spp.	Hyalella spp.			
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		SSC	ARSSC, BLM, USFS
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	SSC	ARSSC, BLM
Taricha torosa	Coast Range Newt		SSC	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS AND OTHER INVERTS				

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Ambrysus amargosus	Ash Meadows Naucorid			
Ambrysus spp.	Ambrysus spp.			
Anax junius	Common Green Darner			
Argia agrioides	California Dancer			
Argia spp.	Argia spp.			
Baetis tricaudatus	A Mayfly			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Caenis bajaensis	A Mayfly			
Chironomidae fam.	Chironomidae fam.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corixidae fam.	Corixidae fam.			
Cricotopus annulator				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Dicrotendipes adnilus				Not on any status lists
Dicrotendipes spp.	Dicrotendipes spp.			
Enallagma civile	Familiar Bluet			
Eukiefferiella claripennis				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Hydropsyche alternans				Not on any status lists
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila ajax	A Caddisfly			
Hydroptila spp.	Hydroptila spp.			
Ischnura barberi	Desert Forktail			
Ischnura denticollis	Black-fronted Forktail			
Leucorrhinia glacialis	Crimson-ringed Whiteface			
Leucorrhinia spp.	Leucorrhinia spp.			
Micropsectra nigripila				Not on any status lists
Micropsectra spp.	Micropsectra spp.			
Nectopsyche dorsalis	A Caddisfly			
Nectopsyche spp.	Nectopsyche spp.			
Orthocladius appersoni				Not on any status lists
Orthocladius spp.	Orthocladius spp.			
Pantala flavescens	Wandering Glider			
Pantala hymenaea	Spot-winged Glider			
Pentaneura inconspicua				Not on any status lists
Pentaneura spp.	Pentaneura spp.			

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Phaenopsectra dyari				Not on any status lists
Phaenopsectra spp.	Phaenopsectra spp.			
Plathemis lydia	Common Whitetail			
Polypedilum albicorne				Not on any status lists
Polypedilum spp.	Polypedilum spp.			
Rheotanytarsus hamatus				Not on any status lists
Rheotanytarsus spp.	Rheotanytarsus spp.			
Sigara alternata				Not on any status lists
Sigara spp.	Sigara spp.			
Sperchon spp.	Sperchon spp.			
Sperchon stellata				Not on any status lists
Sympetrum corruptum	Variegated Meadowhawk			
Tanytarsus angulatus				Not on any status lists
Tanytarsus spp.	Tanytarsus spp.			
Telebasis salva	Desert Firetail			
Tramea lacerata	Black Saddlebags			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Helisoma spp.	Helisoma spp.			
Menetus opercularis	Button Sprite			CS
Menetus spp.	Menetus spp.			
Physa acuta	Pewter Physa			Not on any status lists
Physa spp.	Physa spp.			
Planorbella binneyi	Coarse Rams-horn			CS
Planorbella spp.	Planorbella spp.			
PLANTS				
Alisma triviale	Northern Water-plantain			
Allium validum	Tall Swamp Onion			
Alnus rhombifolia	White Alder			
Alopecurus aequalis aequalis	Short-awn Foxtail			
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Ammannia robusta	Grand Redstem			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla filiculoides	NA			
Baccharis glutinosa	NA			Not on any status lists
Baccharis salicina				Not on any status lists
Bergia texana	Texas Bergia			
Bidens laevis	Smooth Bur-marigold			
Bistorta bistortoides				Not on any status lists
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Callitriche palustris	Vernal Water-starwort			
Carex alma	Sturdy Sedge			
Carex amplifolia	Bigleaf Sedge			
Carex densa	Dense Sedge			
Carex fissuricola	Cleft Sedge			
Carex integra	Smooth-beak Sedge			
Carex jonesii	Jones' Sedge			
Carex lasiocarpa	Slender Sedge		SSC	CRPR - 2B.3
Carex nebrascensis	Nebraska Sedge			
Carex nervina	Sierra Sedge			
Carex sartwelliana	Yosemite Sedge			
Carex senta	Western Rough Sedge			
Carex spectabilis	Northwestern Showy Sedge			
Carex utriculata	Beaked Sedge			
Carex vesicaria vesicaria	Inflated Sedge			
Castilleja miniata miniata	Greater Red Indian-paintbrush			
Castilleja minor minor	Alkali Indian-paintbrush			
Cephalanthus occidentalis	Common Buttonbush			
Cyperus acuminatus	Short-point Flatsedge			
Cyperus erythrorhizos	Red-root Flatsedge			
Datisca glomerata	Durango Root			
Downingia bella	Hoover's Downingia			
Eleocharis bella	Delicate Spikerush			

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis quinqueflora	Few-flower Spikerush			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Epilobium oregonense	Oregon Willow-herb			
Erigeron coulteri	Coulter's Fleabane			
Eriophorum crinigerum	Fringed Cotton-grass			
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euphorbia hooveri	NA			Not on any status lists
Galium trifidum	Small Bedstraw			
Gentiana calycosa	Explorer's Gentian			
Gentianella amarella acuta	Autumn Dwarf Gentian			
Gentianopsis holopetala	Sierra Gentian			
Gentianopsis simplex	One-flower Gentian			
Glyceria elata	Tall Mannagrass			
Helenium bigelovii	Bigelow's Sneezeweed			
Helenium puberulum	Rosilla			
Hosackia oblongifolia	NA			1.B.3
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Isoetes bolanderi	NA			
Juncus dubius	Mariposa Rush			
Juncus effusus effusus	NA			
Juncus effusus pacificus				
Juncus macrandrus	Long-anther Rush			
Juncus macrophyllus	Longleaf Rush			
Juncus mertensianus	Mertens' Rush			
Juncus xiphioides	Iris-leaf Rush			
Kyhosia bolanderi				Not on any status lists
Lasthenia ferrisiae	Ferris' Goldfields		SSC	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lepidium oxycarpum	Sharp-pod Pepper-grass			
Lilium kelleyanum	Kelley's Lily			

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Limnanthes montana	Mountain Meadowfoam			
Ludwigia peploides peploides	NA			Not on any status lists
Lythrum californicum	California Loosestrife			
Marsilea vestita vestita	NA			Not on any status lists
Micranthes aprica				Not on any status lists
Micranthes odontoloma				Not on any status lists
Micranthes oregana	NA			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Myosurus minimus	NA			
Narthecium californicum	California Bog Asphodel			
Navarretia intertexta	Needleleaf Navarretia			
Oenanthe sarmentosa	Water-parsley			
Orcuttia inaequalis	San Joaquin Valley Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Oreostemma alpigenum andersonii	Anderson's Tundra Aster			
Orthilia secunda	One-side Wintergreen			
Oxypolis occidentalis	Western Cowbane			
Panicum acuminatum acuminatum				Not on any status lists
Panicum acuminatum lindheimeri				Not on any status lists
Paspalum distichum	Joint Paspalum			
Pedicularis attollens	NA			
Pedicularis groenlandica	NA			
Perideridia gairdneri gairdneri	Gairdner's Yampah		SSC	CRPR - 4.2
Perideridia parishii latifolia	Parish's Yampah			
Perideridia parishii parishii	Parish's Yampah		SSC	CRPR - 2B.2
Perideridia pringlei	Pringle's Yampah		SSC	CRPR - 4.3
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phacelia distans	NA			

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Phalaris arundinacea	Reed Canarygrass			
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Platanthera sparsiflora sparsiflora	Canyon Bog Orchid			
Platanus racemosa	California Sycamore			
Pluchea odorata odorata	Scented Conyza			
Pogogyne douglasii	NA			
Porterella carnosula	Western Porterella			
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton nodosus	Longleaf Pondweed			
Primula jeffreyi				Not on any status lists
Primula tetrandra	NA			Not on any status lists
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Puccinellia simplex	Little Alkali Grass			
Ranunculus alismifolius alismifolius	Water-plantain Buttercup			
Ranunculus hystriculus				Not on any status lists
Rhododendron columbianum				Not on any status lists
Rhododendron occidentale occidentale	Western Azalea			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rumex conglomeratus	NA			
Rumex salicifolius salicifolius	Willow Dock			
Rumex violascens	Violet Dock			
Sagina saginoides	Arctic Pearlwort			
Sagittaria longiloba	Longbarb Arrowhead			

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Sagittaria montevidensis calycina				Not on any status lists
Salix drummondiana	Satiny Salix			
Salix eastwoodiae	Eastwood's Willow			
Salix exigua exigua	Narrowleaf Willow			
Salix exigua hindsiana				Not on any status lists
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix lemmonii	Lemmon's Willow			
Salix melanopsis	Dusky Willow			
Scirpus microcarpus	Small-fruit Bulrush			
Senecio triangularis	Arrow-leaf Groundsel			
Sidalcea calycosa calycosa	Annual Checker-mallow			
Sidalcea hirsuta	Hairy Checker-mallow			
Sidalcea ranunculacea	Marsh Checker-mallow			
Sisyrinchium elmeri	Elmer's Blue-eyed-grass			
Solidago elongata				Not on any status lists
Sparganium angustifolium	Narrowleaf Bur-reed			
Sphenosciadium capitellatum	Swamp Whiteheads			
Spiranthes romanzoffiana	Hooded Ladies'-tresses			
Stachys albens	White-stem Hedge-nettle			
Triglochin palustris	Slender Bog Arrow-grass		SSC	CRPR - 2B.3
Tuctoria greenei	Green's Awnless Orcutt Grass	Endangered	Rare	CRPR - 1B.1
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Vaccinium uliginosum occidentale				Not on any status lists
Veronica americana	American Speedwell			
Viola macloskeyi	NA			
FISHES				
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013

Scientific Name	Common Name	Legally Protected Status		
		Federal	State	Other
Lampetra hubbsi	Kern brook lamprey		SSC	Vulnerable - Moyle 2013, USFS
Lavinia exilicauda exilicauda	Sacramento hitch		SSC	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		SSC	Near-Threatened - Moyle 2013
Mylopharodon conocephalus	Hardhead		SSC	Near-Threatened - Moyle 2013, USFS
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013

Notes:
ARSSC = At-Risk Species of Special Concern
BCC = Bird of Conservation Concern
BSSC = Bird Species of Special Concern
CRPR = California Rare Plant Rank
CS = Currently Stable
IUCN = International Union for Conservation of Nature
SSC = Species of Special Concern

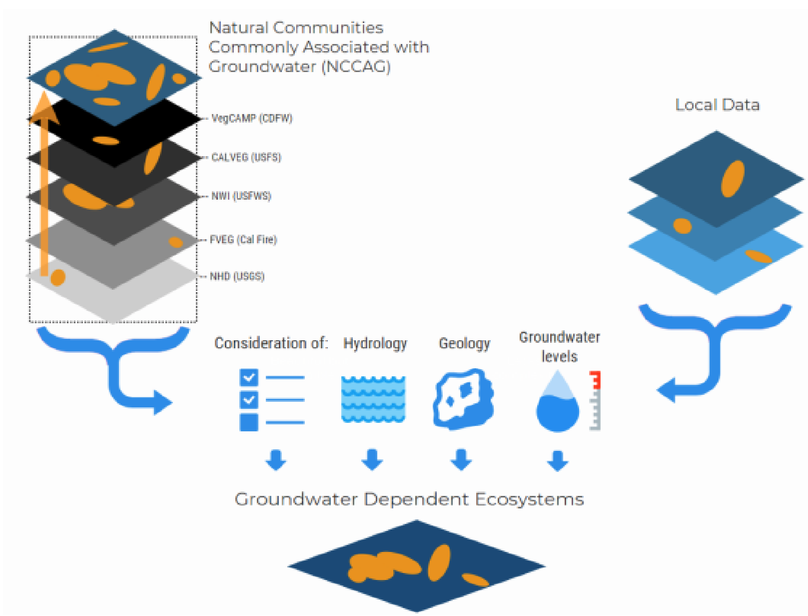
Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[6] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[7]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[6] *NC Dataset Online Viewer:* *https://gis.water.ca.gov/app/NCDatasetViewer/*

[7] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[8]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[9] on the Groundwater Resource Hub[10], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[8] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*

[9] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[10] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

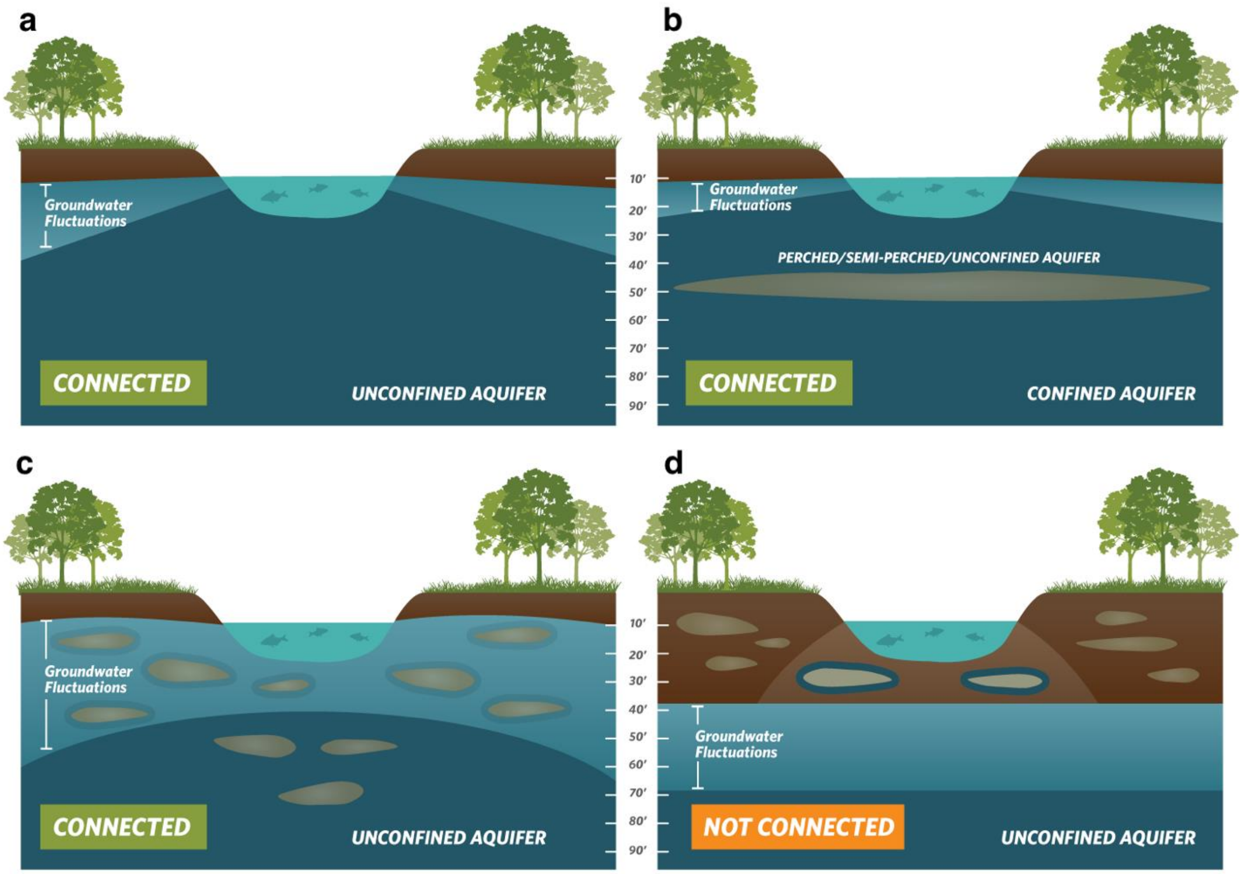

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[11] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[12] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[13] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[14]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

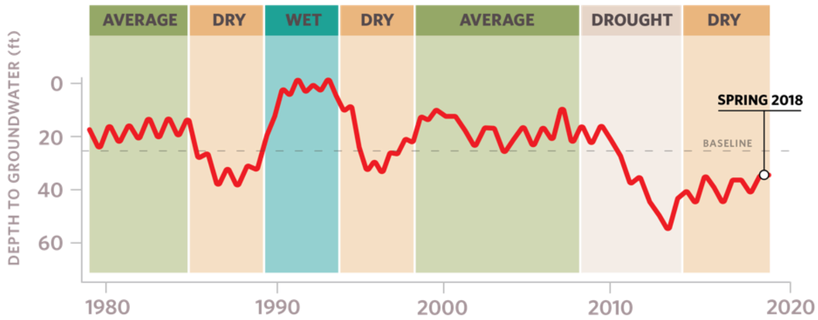

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[11] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[12] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[13] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[14] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[15], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

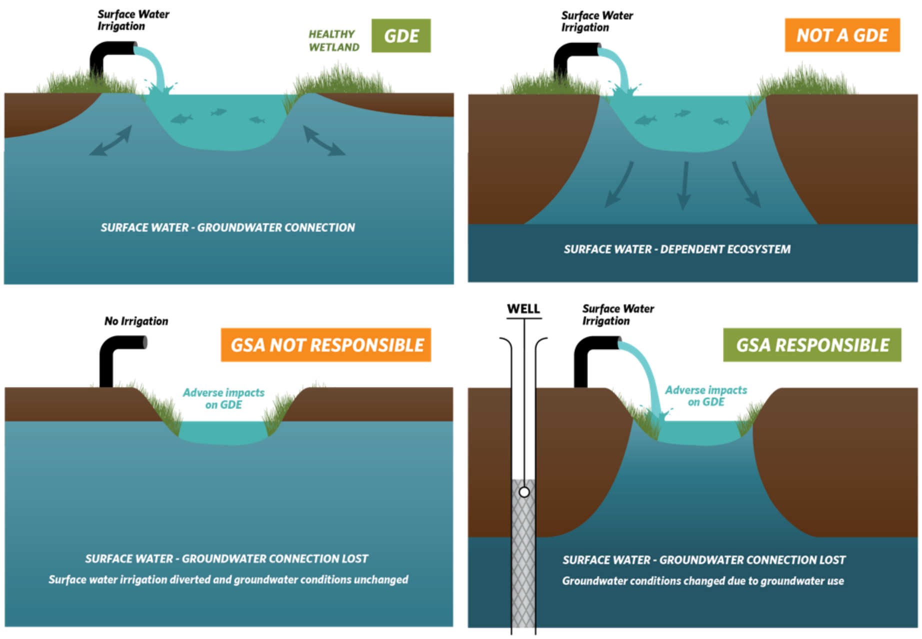

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[15] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

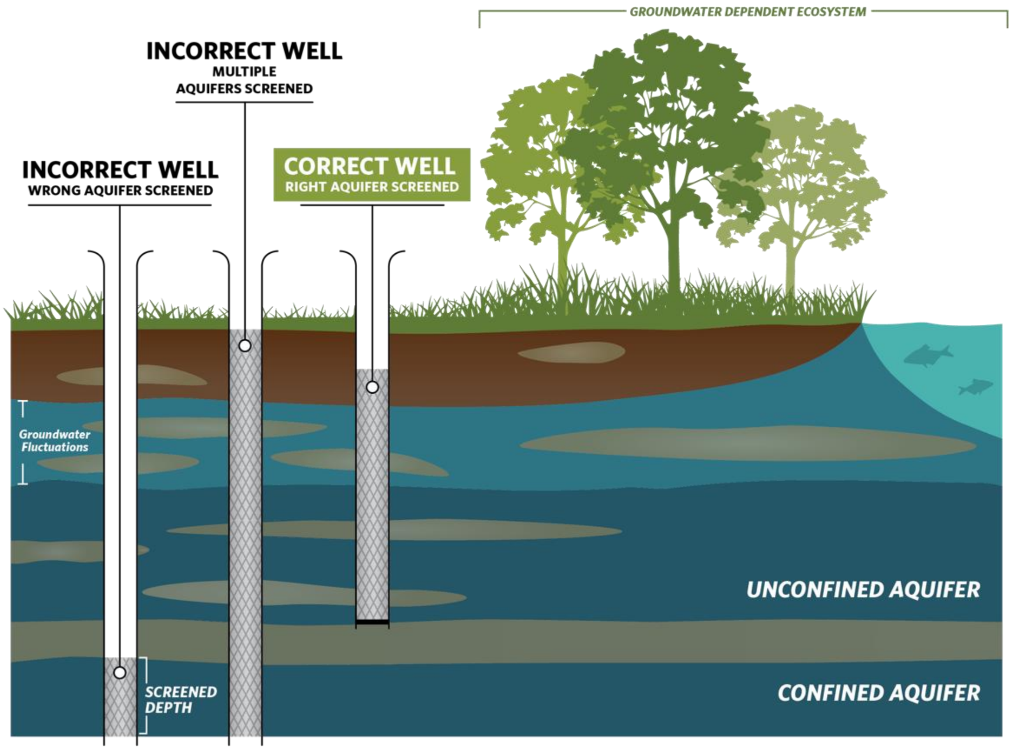

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[16] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

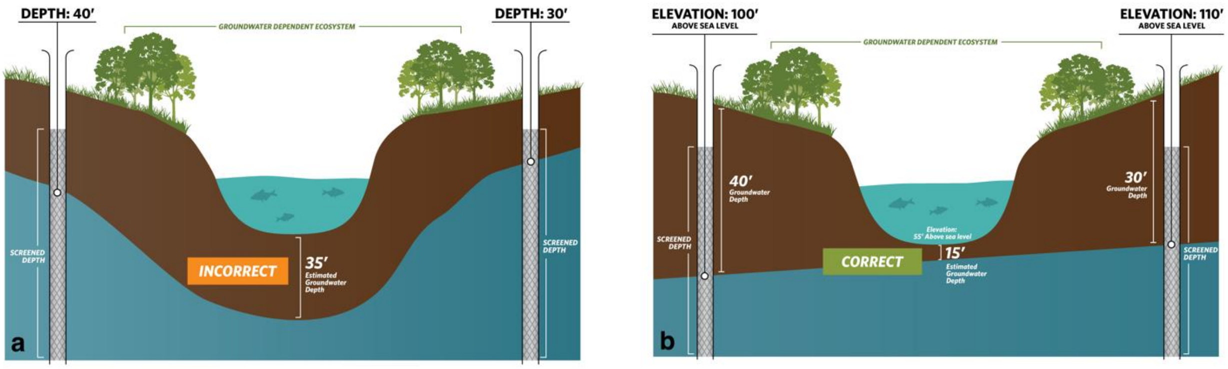

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

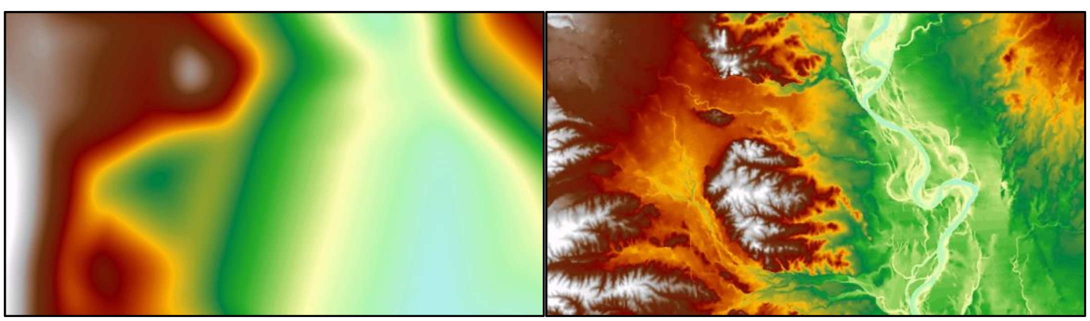

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[16] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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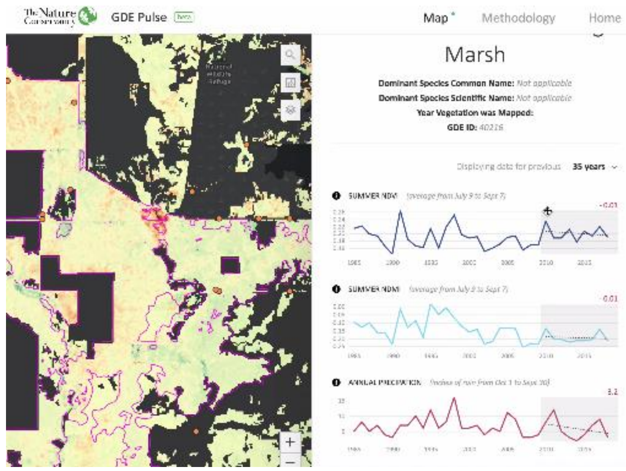
Visit
https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[17]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[18]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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[17] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[18] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[19]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[20]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[21] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[19] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[20] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[21] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Tulare Lake Subbasin Groundwater Sustainability Plan (GSP)

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Tulare Lake Subbasin Groundwater Sustainability Plan (GSP or Plan) prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing *sustainable* groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be insufficient in addressing environmental beneficial uses and users.

The identification of environmental beneficial users, as well as their consideration when establishing the sustainability goal, undesirable results, minimum thresholds and measurable objectives were unreasonable (23 CCR §355.4(b)(4)) and lacked best available science (23 CCR §355.4(b)(1)). In the face of existing, severe overdraft, the GSP would allow groundwater management to largely ignore potential impacts to environmental beneficial users. This could result in irreparable harm to these beneficial users, undermining the intent of SGMA to achieve sustainability.

Many of the deficiencies can be addressed now, and we encourage the Department to require these corrections prior to approval. In some case, it may be difficult to address deficiencies within 180 days. In these cases, we strongly recommend that the Department, at a minimum, set clear expectations that these be corrected in the 2025 plan update and, to the degree that deficiencies are due to data gaps, that these data gaps be addressed in time to inform the 2025 update. SGMA's success is contingent upon avoiding undesirable results. Should the treatment of environmental beneficial users be indicative of the quality of the overall plan, then we recommend the Department deem the plan inadequate.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data. Attachment F provides the GSA's response to TNC's comments on the Draft GSP. Attachment G provides a map and method summary on potential ISWs.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We are disappointed to see the feedback that we provided on the draft GSP has been discounted in the final plan, as only 1 out of 58 comments were adequately addressed in the Final GSP. This indicates poor engagement of environmental beneficial users, which undermines the intent of SGMA to ensure that sustainability be defined locally with the participation of all users. Based on our experience the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan" (23 CCR §355.4(b)(10)).

TNC recommendation: We strongly recommend that DWR require the GSA to prioritize stakeholder engagement through improvements to their stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters – The GSP incorrectly excluded potential and/or actual ISWs because the plan did not employ the best available science. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)).

The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting EBUs of groundwater and surface water. ISWs can be either gaining or losing. The GSP incorrectly asserts that hydrologic conditions have been so altered that the ISWs that were historically connected are not any longer. The GSP did not provide comprehensive monitoring data or robust, quantitative analysis to back up the statement. There are also inconsistencies throughout the GSP in regards to ISWs.

Map and Assessment of potential ISWs:
By combining multiple years and seasons of groundwater depth data, The Nature Conservancy has determined that within the Tulare Lake Subbasin GSP, 19.4 miles of rivers have an uncertain connection to groundwater. Attachment F contains a one-page method summary and a GSP-specific map of ISWs. The interconnected surface water displayed on the map is based on the

minimum groundwater depth estimated by the California Department of Water Resources between 2011 and 2018.

Note: In most cases, the groundwater depth data used to generate the ISW map does not include perched aquifers. As such, some streams marked as disconnected could in actuality, be connected.

TNC recommendation: Until a disconnection can be proven, TNC recommends that the GSP include all potential and confirmed ISWs. Where data gaps exist, we recommend that the GSP describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water. Please see our detailed feedback in Attachment B.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 7,775 acres of potential GDEs occur in the GSA boundary. TNC developed the Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

The plan does not to adequately identify, map and consider GDEs. We believe that this constitutes gaps in meeting plan evaluation criteria (1), (4) and (10), as defined in the 23 CCR §355.4(b). In addition, the Plan does not satisfy the requirement to identify GDEs (23 CCR §Section 354.16(g)) and consider beneficial users throughout the plan. Our review found that NC Dataset polygons were improperly removed from the GDE map based on the following:

- GDEs were rejected on the basis that groundwater levels were greater than 30-feet at a single point in time. This is a technically incorrect approach since groundwater levels fluctuate over seasonal and interannual time scales due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Justifying the removal of NC dataset polygons solely based on this criterion does not acknowledge that groundwater levels temporally vary and the fact that many plant species within GDEs can access groundwater depths beyond 30-ft or have adapted water stress strategies to deal with intermittent periods of deep groundwater levels. Using this methodology disregards groundwater fluctuations and can leave many GDEs unprotected in the GSP.

- The GSP did not provide information on the historical or current groundwater conditions specifically near the GDEs or the ecological conditions present. If data gaps exist, please acknowledge them and state how they may be reconciled in the future. The GSP did not provide an ecological inventory for the potential GDEs that includes vegetation or habitat types. Furthermore, the GSP did not identify whether any endangered or threatened freshwater animal species or plants, or areas with critical habitat were found in or near any of the GDEs since some organisms rely on uplands and wetlands during different stages of their lifecycle.

TNC recommendation: The GSP should utilize groundwater levels that represent interannual and inter-seasonal variability along with additional information provided in our BMP guidance document (Attachment D) to identify and consider GDEs in the GSP. Specifically, please ensure

[1] Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

that a Digital Elevation Model (DEM) is used when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment D.

Water Budget – We were disappointed to see that the water budget did not include the current, historical and projected demands of native vegetation and/or managed wetlands, as required under SGMA (23 CCR §354.18(a) and (b)(3)). Evapotranspiration (ET) is included as an outflow category in the water budget; however, it is only included as it pertains to crop water requirements. This is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget nor will they likely be considered in project and management actions.

TNC recommendation: As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not consider protection of environmental users of groundwater and interconnected surface waters, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). The GSP states that there is no ISW connectivity within the entire Subbasin, but data to support this broad assertion are insufficient to dismiss this sustainability indicator. Both GDEs and ISWs are not explicitly recognized in the establishment of sustainable management criteria. This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

Monitoring Network – We were disappointed to see that the monitoring network is not designed to, as required by 23 CCR §354.34: (1) ensure adequate coverage of the sustainability indicators, (2) characterize the spatial and temporal exchanges between surface water and groundwater, nor (3) calibrate and apply the tools and methods necessary to calculate the depletions of surface water caused by groundwater extractions. As a result, the monitoring network does not adequately characterize GDEs and other environmental beneficial users of surface water and groundwater. The GSP should reconcile data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells, GDE and ISW responses to groundwater levels) along rivers, creek and the Tulare Lakebed to improve ISW and GDE mapping in future GSPs. Representative Monitoring Sites should be identified and added to the GSP in order to better understand the interaction of the A-Clay and C-Clay layers with the unconfined aquifer, and potential GDEs and ISWs.

TNC recommendation: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess potential impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but *sustainable* groundwater management that considers the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

<table>
<tr><td rowspan="13"></td><td rowspan="11"></td><td rowspan="3">If NC Dataset was used:</td><td>Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).</td><td>12</td></tr>
<tr><td>The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).</td><td>13</td></tr>
<tr><td>GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.</td><td>14</td></tr>
<tr><td>If NC Dataset was not used:</td><td>Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.</td><td>15</td></tr>
<tr><td colspan="2">Description of GDEs included:</td><td>16</td></tr>
<tr><td colspan="2">Historical and current groundwater conditions and variability are described in each GDE unit.</td><td>17</td></tr>
<tr><td colspan="2">Historical and current ecological conditions and variability are described in each GDE unit.</td><td>18</td></tr>
<tr><td colspan="2">Each GDE unit has been characterized as having high, moderate, or low ecological value.</td><td>19</td></tr>
<tr><td colspan="2">Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).</td><td>20</td></tr>
<tr><td rowspan="2">2.2.3
Water Budget
23 CCR §354.18</td><td colspan="2">Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.</td><td>21</td></tr>
<tr><td colspan="2">Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.</td><td>22</td></tr>
<tr><td rowspan="11">Sustainable Management Criteria</td><td rowspan="3">3.1
Sustainability Goal
23 CCR §354.24</td><td colspan="2">Environmental stakeholders/representatives were consulted.</td><td>23</td></tr>
<tr><td colspan="2">Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.</td><td>24</td></tr>
<tr><td colspan="2">Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.</td><td>25</td></tr>
<tr><td>3.2
Measurable Objectives
23 CCR §354.30</td><td colspan="2">Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.</td><td>26</td></tr>
<tr><td rowspan="3">3.3
Minimum Thresholds
23 CCR §354.28</td><td colspan="2">Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:</td><td>27</td></tr>
<tr><td colspan="2">Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?</td><td>28</td></tr>
<tr><td colspan="2">Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?</td><td>29</td></tr>
<tr><td rowspan="3">3.4
Undesirable Results
23 CCR §354.26</td><td colspan="2">For GDEs, hydrological data are compiled and synthesized for each GDE unit:</td><td>30</td></tr>
<tr><td rowspan="2">If hydrological data are available within/nearby the GDE</td><td>Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).</td><td>31</td></tr>
<tr><td>Baseline period in the hydrologic data is defined.</td><td>32</td></tr>
</table>

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf.

Attachment B

TNC Evaluation of the
Tulare Lake Subbasin Groundwater Sustainability Plan

The Tulare Lake GSP, adopted November 26, 2019 as Resolution 2019-119, was reviewed by TNC. Responses to comments on the public draft were in included as Appendix C to the GSP, which we have included in this letter as Attachment F. The GSA did not address our individual comments in their response to comments, but instead provided a general response to our comment letter. Therefore, to determine if/what changes were made to the Final GSP text that addressed TNC's previously submitted comments, we compared the Public Draft GSP to the Final GSP. This attachment lists our original comments on the complete Public Draft GSP, as submitted to the South Fork Kings Groundwater Sustainability Agency (GSA) during the public comment period, and states whether or not they were addressed in the Final GSP [as green text within brackets]. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

[Section 2.5.3 Beneficial Uses and Users (p. 2-29)]

- *[Our comment was not addressed in the GSP. No changes to the GSP text were made.]* The flow chart on p. 2-29 shows the engagement process with groundwater users during the development and implementation of the GSP. Table 2-4 identifies all the beneficial uses and users of groundwater within the Subbasin by GSA in greater detail, but does not include environmental uses and users. Users identified include agricultural, public water systems, domestic well owners, municipal water systems, planning agencies, Native American Tribes, Disadvantaged Communities, monitoring entities, and surface water users (as represented by GSA members). California Water Code §1305(f) defines that beneficial uses of waters of the State include "preservation and enhancement of fish, wildlife, and other aquatic resources and preserves". **Please expand Table 2-4 to include environmental uses and users that are present in the Subbasin, such as:**
    - **ecological areas; preserves; potential ISWs and GDEs; managed wetlands;**
    - **Protected Lands, including conservation areas; and**
    - **Public Trust Uses including wildlife, aquatic habitat, fisheries, and recreation.**

Checklist Items 2 to 4 - Description of the Plan Area (23 CCR §354.8)

[Section 2.0 Plan Area (pp. 2-1 to 2-2)]

- *[Our comment was not addressed in the GSP. No changes to the GSP text were made.]* The types and locations of environmental uses, species and habitats supported, and the designated beneficial environmental uses and users of surface waters that may be affected by groundwater extraction in the Subbasin should be specified in the section and in Table 2-4. **Please elaborate on the "surface water uses and users" by identifying the environmental uses and users of surface water <u>for all GSAs in Table 2-4</u>. Please explicitly identify the environmental users and take particular note of the species with protected status and any critical habitat that exists within the Subbasin.** The following are resources that can be used:

  - Natural Communities Commonly Associated with Groundwater dataset (NC Dataset) - https://gis.water.ca.gov/app/NCDatasetViewer/
  - The list of freshwater species located in the Tulare Lake Subbasin in Attachment C of this letter.
  - The California Department of Fish and Wildlife's California Natural Diversity Database (CNDDB) for species occurrences.
  - The USFWS's Environmental Conservation Online System (ECOS) for mapping critical habitat, wildlife and contaminants - https://ecos.fws.gov/ecp/

- *[Our comment was not addressed in the GSP. No changes to the GSP text were made.]* The GSP addresses state and federal land ownership to some degree, but there is no mention of uses related to open space areas, managed wetlands, natural preserve areas, or other protected lands that contain natural resources. Per the USFWS ECOS website the Kern National Wildlife Refuge Complex, Tulare Basin Wildlife Management Area (on southern boundary), and Pixley National Wildlife Refuge (to the east of Highway 43) abut the GSP area. Within these areas there is critical habitat mapped for the Buena Vista Lake ornate shrew (*Sorex ornatus relictus*) near the Lemoore Naval Air Station and in the Kern National Wildlife Refuge, and the vernal pool fairy shrimp (*Branchinecta lynchyi*) in the Pixley National Wildlife Refuge. These habitat areas or species are not addressed in the description of the plan area, nor are sensitive habitats within the plan area acknowledged.
  - **Please identify the natural resources within the plan area and elaborate on any and all state, federal or other land ownership that exists within the plan area that provide protection of natural resources.**
  - **Please address how the GSP will address natural resource management on a regional scale since management within the GSP could affect neighboring sensitive resources.**
- *[Our comment was not addressed in the GSP. No changes to the GSP text were made.]* The GSP goes on to state on p. 2-2 that the primary land use designations are for agricultural, urban, residential, commercial and industrial lands; however, the figure (pie chart) on that page shows riparian vegetation and water surface land use classifications that amount to more than residential and semi-agricultural. **Please revise the statement concerning primary land use designations to accurately reflect the percentages on the chart (i.e., agricultural, urban, riparian vegetation, water surface, etc.). Please identify the natural resources within the plan area and elaborate on any and all state, federal or other land ownership that exists within the plan area that provide protection of natural resources.**

- *[Minor changes to the GSP text do not adequately address our comment.]* On page 2-2, it is stated that it was not possible to differentiate types of well uses between irrigation and domestic extractors because DWR does not have that data. However, these data are available on well completion reports which may be accessed online through the GeoTracker GAMA website (https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/Default.asp). This is the approach taken in almost every other GSP we have reviewed and is an important distinction of use as it relates to prioritization of project needs and management decisions. _**Please either address this issue or identify this as a data gap to reconcile in the 5-year GSP update.**

[Section 2.1 Summary of Jurisdictional Areas and Other Features (pp. 2-3 to 2-11)]

- *[Minor changes to the GSP text do not adequately address our comment.]* The Plan summarizes the GSP Area and describes the jurisdictional areas and entities of the GSAs, but does not say anything about the jurisdictional areas of the resource agencies. **Please elaborate on the jurisdictional areas of the resource agencies and what resources they are in place to protect.**
- *[Minor changes to the GSP text do not adequately address our comment.]* With exception of a short description of the Kings River Fisheries Management Program in Section 2.2.2.4, the GSP does not provide a description of other instream flow requirements, if any, or how the water infrastructure is in compliance with regulatory requirements set to protect species of concern. **Please provide a description of any current and planned instream flow requirements for Tulare Subbasin streams / rivers including Kings, Tule, White, Kaweah, and St. John's Rivers; and undammed streams including Deer, Dry, Mill, Cottonwood, and Poso Creeks. If there are no other instream flow requirements in place or planned, then please state that in the document.**

[Section 2.2.1 Monitoring and Management Programs (pp. 2-11 to 2-13)]

- *[Minor changes to the GSP text do not adequately address our comment.]* This section addresses the water resources management actions that are being undertaken to monitor groundwater level, extraction and quality; subsidence; irrigated lands; and surface water. Management of natural resources is not considered in this section but should be described in order to provide a context for how groundwater management actions will be coordinated with environmental requirements to prevent undesirable results. **Please include a description of the natural resource management and monitoring programs occurring within the GSP area that affects instream, wetland and riparian ecosystems that have the potential to be groundwater dependent (i.e., interconnected surface water [ISWs] and groundwater dependent ecosystems [GDEs]).**

[Section 2.3 Relation to General Plans (pp. 2-15 to 2-21)]

- *[Minor changes to GSP text do not adequately address our comment.]* The GSP includes a very short description of the general plans within the GSP area but fails to specifically elaborate on the goals and policies outlined in the plans, and how the

GSP will fit in with or affect the general plans' goals and policies related to the protection and management of GDEs, ISWs and aquatic resources that could be affected by groundwater withdrawals. **Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources, other GDEs and ISWs, and related threatened or endangered species.**

- *[Our comment was not addressed in the GSP. No changes to the GSP text were made.]* This section should identify other land use plans, including Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin and if they are associated with areas with instream flow requirements; or critical, GDE or ISW habitats. **Please identify all relevant HCPs and NCCPs within the Subbasin, and any reaches with instream flow and critical habitat requirements. Please elaborate on the natural resources within the Subbasin and address how GSP implementation will coordinate with the goals of these plans and requirements. If there are no HCPs, NCCPs, or preservation areas that could be affected, then that should be stated.** The Critical Species Lookbook[2] includes the potential groundwater reliance of critical species in the basin. **Please include a discussion regarding the management of critical species and their habitats for these aquatic ecosystems and its relationship to the GSP.**
- *[Our comment was not addressed in the GSP. No changes to the GSP text were made.]* **Please describe how the GSP will coordinate with the General Plan elements within the GSP area. Specifically, please elaborate on conservation, recreation and open space elements.**
- *[Minor changes to GSP text do not adequately address our comment.]* This section states (p. 2-15) that "It is considered unlikely that any Kern County General Plan Policies have any practical relevance to the plan area". The Kern National Wildlife Refuge Complex abuts the GSP area and it is difficult to understand that the General Plan for Kern County does not address habitat concerns and conservation that could be directly or indirectly affected by potential groundwater management actions within and adjacent to the Kern Subbasin. **Please 1) elaborate on the Kern County General Plan's conservation elements, 2) how the Tulare Lake Subbasin's GSP will comply with or not impact conservation elements being employed within protected habitat areas adjacent to the Tulare Subbasin, and 3) expand this conversation to include other neighboring habitat areas, such as Pixley National Wildlife Refuge.**

[Section 2.3.4 Permitting Process for New or Replacement Wells (pp. 2-18 to 2-20)]

- *[Our comment was not addressed in the GSP. No changes to the GSP text were made.]* This section summarizes well permitting requirements and county ordinances for the counties of Kings, Kern and Tulare. **Please include a discussion of the following in this section:**

[2] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

- Future well permitting must be coordinated with the GSP to assure achievement of the Plan's sustainability goals.
- How the well permitting process incorporates protection of GDEs within the Subbasin.
- The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF v. SWRCB and Siskiyou County, No. C083239). **The need for well permitting programs to comply with this requirement should be stated in the text.**

<u>Checklist Items 5 to 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)</u>

[Section 3.1.7 Definable Bottom of the Basin (pp. 3-15 to 3-18)]

- *[Our comment was not addressed in the GSP. No changes to the GSP text were made.]* The GSP uses two methods (Water Quality and Geologic) to define the bottom of the basin but which method, or combination of the methods, that is being relied on for this GSP is not clearly stated. **Please explicitly state the final decision on how the bottom of the basin was determined, and what it was determined to be.**
- *[Our comment was not addressed in the GSP. No changes to the GSP text were made.]* Defining the bottom of the Subbasin based on geochemical properties is a suitable approach for defining the base of freshwater, however, as noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** This will prevent the possibility of extractors with wells deeper than the basin boundary (defined by the base of freshwater) from claiming exemption of SGMA due to their well residing outside the vertical extent of the basin boundary. **Please characterize groundwater well extractions from the deepest wells in relation to defining the basin bottom**.

[Section 3.1.8 Hydrogeologic Setting: Principal Groundwater Aquifers and Aquitards (pp. 3-18 to 3-23)]

- *[Minor changes to GSP text do not adequately address our comment.]* Although there is robust description of the confined (lower) and unconfined / semi-confined (upper) aquifers there is no explicit description with supporting data and information of how groundwater above the A- and C-clays in the upper aquifer interacts with the unconfined aquifer, or is influenced by pumping in the unconfined portion of the upper aquifer. DWR's definition of a principal aquifer, is defined as an "aquifer or aquifer system that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems" [*23 CCR §351(aa)*]. These shallow and perched areas within the upper aquifer range from near surface to 30 feet below ground surface (bgs) (Figure 3-17) and likely provide water supply to GDEs and ISWs. As such, they yield significant quantities of groundwater to surface water systems and beneficial users, and should not be dismissed because they do not yield groundwater for human use. **Please expand the description of the upper aquifer to include the interaction of the unconfined and shallow areas of the upper aquifer. Include cross-sections to show their connectivity and relationship to potential ISWs and GDEs.**

- *[Our comment was not addressed in the GSP. No changes to the GSP text were made.]* Regional geologic cross sections are provided in Figures 3-14a, 3-14b and 3-14c. These cross-sections do not include a graphical representation of the shallow groundwater-bearing zones that may be connected to GDEs and ISWs in the GSP area, and how they are connected to the upper aquifer system. **Please include example near-surface cross section details that depict the conceptual understanding of shallow groundwater and stream interactions at different locations, including the shallow zones, any perched aquifers, and the unconfined / semi-confined upper aquifer**.
- *[Minor changes to GSP text do not adequately address our comment.]* Based on the information provided in the GSP, it appears that the confined lower aquifer is being considered a principal aquifer because of the large amount of consumption for agriculture and municipal water supply, but this is not explicitly stated. The unconfined / semi-confined aquifer is stated to have limited use because of water quality. On pages 3-17 and 3-18, there is a discussion of water quality and although water with TDS higher than 3,000 is not considered suitable for water supply or most agriculture, it is potentially suitable for livestock and production of crops with higher tolerance to salinity. Conversely, in Section 3.1.11 (page 3-25), the GSP states that the upper aquifer is primarily used for domestic and municipal supplies, and agricultural pumping does occur in the deeper portion of the upper aquifer. Also, if water in the unconfined aquifer is significantly supporting GDEs and ISWs, production of salt tolerant crops, or livestock operations, then it should also be identified as a principal aquifer. Even if ultimately the GSA doesn't define shallow groundwater as a principal aquifer, the text indicates current or future use that could impact ISWs and GDEs. **Thus, disregarding this shallow groundwater as a principal aquifer due to its water quality is not supported by the data and is inadequate.** SGMA requires GSAs to sustainably manage groundwater resources in all aquifers, especially if groundwater use and management can result in impacts to beneficial uses and users. Please refer to Best Practice #1 in Attachment D for further explanation and accompanying graphics. **Please explicitly enumerate the principal aquifer(s) and intervening aquitards, their relationship to each other, and their role in supplying groundwater to all beneficial uses and users of groundwater (including environmental).**

[Section 3.2 Groundwater Conditions (pp. 3-26 to 3-29)]

- *[Minor changes to GSP text do not adequately address our comment.]* Groundwater elevation contours are shown for 1905-1907, 1952, 1990, 1995, 2000, 2005, 2010 and 2016 on Figures 3-24 through 3-27 with respect to mean sea level. However, the wells used to contour groundwater levels in the upper aquifer do not necessarily monitor shallow or perched groundwater that may be in communication with GDEs and ISWs. In addition, depth to groundwater cannot be readily assessed from the maps because they are presented with respect to sea level. **Please provide the following:**

1) **Groundwater level contour maps representative of the uppermost aquifer where GDEs and ISWs may be reliant. If this data does not exist, then identify it as a data gap that will be addressed in the GSP when the GSP is updated.**
2) **Depth to water contour maps that allow interpretation of beneficial groundwater uses by environmental users.**
3) **If these data are not available, please identify this as a data gap and outline measures to address the data gap in subsequent sections of the GSP.**

[Section 3.2.5 Groundwater Quality (pp. 3-30 to 3-32)]

- *[Minor changes to GSP text do not adequately address our comment.]* There is water quality information for the upper aquifer and a statement that increases in TDS concentrations, arsenic, nitrate and volatile organic chemicals (VOCs) are largely due to agricultural practices and pumping, but there is no information regarding water quality of the perched water or other areas of the upper aquifer to understand how water quality may affect GDEs, ISWs and associated aquatic species. **Please modify this section of the GSP to include data about water quality in the zones where GDEs are present. If there are no data available, then please recognize this as a data gap and specify that additional data will be collected and analyzed for the GSP update.**

Checklist Items 8 to 10 – Interconnected Surface Waters (ISWs) (23 CCR §354.16)

[Section 3.1.10 Groundwater Recharge and Discharge Areas (p. 3-24)]

- *[Minor changes to GSP text do not adequately address our comment.]* The text states that "Some discharge is impacted by direct soil evaporation and evapotranspiration, particularly in areas where groundwater is less than 10 feet bgs." Elsewhere the text states that agricultural drainage must be provided in some areas, indicating very shallow groundwater, or makes reference to deeper groundwater levels of about 30 feet for groundwater above the A-Clay. Earlier in this comment letter we pointed out the discrepancy between the various shallow groundwater levels that are presented (see Section 3.2 Groundwater Conditions [pp. 3-26 to 3-29]). This GSP also states that riparian and emergent marsh ecosystems are prevalent in certain areas where they have not already been degraded by land development. **Please 1) rectify the discrepancies in groundwater levels, particularly as they pertain to ISWs and GDEs; and 2) include the locations of phreatophytes and other GDEs to provide a complete representation of evapotranspiration within all groundwater discharge areas. If the regional groundwater connection of phreatophytes and other GDEs is not known, 1) please identify this data gap, 2) provide an approach to address it, and 3)**

include the ISWs and GDEs as potential features on a figure until they can be more conclusively evaluated.

[Section 3.2.8 Interconnected Surface Water and Groundwater Systems (pp. 3-33 to 3-34)]

- The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. ISWs can be either gaining or losing. The GSP disregards IWSs by stating that hydrologic conditions have been so altered that the ISWs that were historically connected are not any longer. There are inconsistencies throughout this GSP in regard to ISWs. The GSP states:
  - *[Minor changes to GSP text do not adequately address our comment.]* Section 3.1.10 (p. 3-24, also see the comment directly above): "Groundwater recharge in the Subbasin occurs primarily by two methods: 1) infiltration of surface water from the Kings River and unlined conveyances; and 2) infiltration of applied water for irrigation of crops." **ISWs can be either gaining or losing (see the definition above). If recharge primarily occurs through infiltration from rivers and streams, then these features must be included as an ISW with gaining and losing reaches defined on a map.**
  - *[Our comment has been adequately addressed through GSP text changes. Thank you for recognizing the data gap and acknowledging shallow monitoring wells are needed to improve identification of ISWs.]* Section 3.2.8 (p. 3-34): "A persistent, shallow perched water table at a depth of about 30 feet bgs is often present above the A-clay in the vicinity of surface water conveyances and below recharge facilities; however, this shallow perched zone is disconnected from the regional unconfined aquifer. Other localized shallow perched zones may exist elsewhere in the Subbasin, but these are not considered a significant source of groundwater." Section 3.1.8 states (p. 3-21) that the perched water is as shallow as 15 feet in some areas, and the groundwater elevation contour maps show it ranging from 0-20 feet AMSL. Data to support the claims about the nature of the perched aquifers is conflicting and the claims that perched units are disconnected or insignificant are not supported by data. **Please clarify the discrepancy between groundwater depths reported for the shallow perched water table that are provided in the text and on figures. If the location and size of other shallow perched zones is unknown, this information needs to be identified as a data gap, rather than a reason to completely disregard the features.** It is inadequate to assume that shallow perched zones are not a significant source of groundwater if they have not been fully characterized and could be a significant source for GDEs and ISWs. **Please reconcile data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the**

Monitoring Network section of the GSP to improve identification of ISWs prior to disregarding them in the GSP.

Checklist Items 11 to 15 – Identifying and Mapping GDEs (23 CCR §354.16)

[Section 3.2.8.1 Groundwater Dependent Ecosystems (GDEs) (p. 3-35 to 3-37)]

- *[Minor changes to the GSP text do not adequately address our comment. The quoted text in our original comment below was removed from the Final GSP, but TNC's bolded requests were not adequately addressed.]* In the text (p. 3-35) it is stated: "Groundwater pumping from the principal aquifer system is not likely to impact the occurrence of perched groundwater because the two systems are separated by the A-Clay aquitard. Perched groundwater above the A-Clay is not directly interconnected with the underlying unconfined / semiconfined aquifer in that pumping from the unconfined / semiconfined aquifer does not induce increased leakage through the A-Clay aquitard." This statement is not supported by the data provided in the GSP (see comments above) and is not a valid reason to disregard potential GDEs without further evidence. The A-Clay is reported to vary significantly in thickness and to contain permeable sands in some locations. **Please:**
    1) **Explicitly identify the principal aquifers;**
    2) **Provide data regarding the competence of the A-Clay as an aquitard**
    3) **Evaluate the potential degree of connection between the perched and unconfined aquifer based on objective data;**
    4) **Acknowledge the extent of the perched aquifers throughout the Subbasin as a data gap;**
    5) **Address data gaps associated with the interconnectivity with the unconfined / semiconfined aquifer to be reconciled in the GSP update; and**
    6) **Acknowledge the potential for GDEs and ISWs to be dependent on these groundwater resources.**
- *[Minor changes to the GSP text do not adequately address our comment.]* Although this GSP did use the NCCAG database to preliminarily identify GDEs (p. 3-36), all were disregarded without acknowledgment of data gaps and further characterization of the natural communities in association with potential perched aquifers, and disparities in groundwater levels that have not yet been characterized. This evaluation potentially misses GDEs due to the potential for GDEs to utilize the shallow and perched areas of the unconfined / semi-confined aquifer. The following comments apply:
    - While depth to groundwater levels within 30 feet are <u>generally</u> accepted as being a <u>proxy</u> for deciding if polygons in the NC dataset are connected to groundwater, it is highly advised that seasonal and interannual groundwater fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one point in time or during a discrete season can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Based on a study we recently submitted to *Frontiers in Environmental Science*, we've observed riparian forests along the Cosumnes River to experience a range in groundwater levels between 1.5 and

75 feet over seasonal and interannual timescales. Seasonal fluctuations in the regional water table can support perched groundwater near an intermittent river that seasonally runs dry due to such fluctuations. While perched groundwater itself cannot directly be managed due to its position in the vadose zone, the water table position within the regional aquifer (via pumping rate restrictions, restricted pumping at certain depths, restricted pumping around GDEs, well density rules, etc.) and its interactions with surface water (e.g., timing and duration) can be managed to prevent adverse impacts to ecosystems due to changes in groundwater quality and quantity under SGMA. **We highly recommend using depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset seasonally and interannually, or to determine conclusively whether shallow groundwater is hydraulically connected (directly or indirectly) to underlying aquifers, include those polygons in the GSP until data gaps are reconciled in the monitoring network, and include specific measures and time tables to address the data gaps.**

- If there are insufficient groundwater level data in the shallow and perched zones, then the NCCAGs in these areas should be included as GDEs in the GSP until data gaps are reconciled in the monitoring network. **Confirmation of GDEs should be based on depth to groundwater in the shallow and perched areas. Please revise the GDE analysis in the GSP to include a complete analysis and identification of data gaps.**
- **Please provide depth to groundwater contour maps and note the following best practices for doing so:**
  - Are the wells used for interpolating depth to groundwater sufficiently close (<5km) to NC Dataset polygons to reflect local conditions relevant to ecosystems?
  - Are the wells used for interpolating depth to groundwater screened within the surficial unconfined aquifer and capable of measuring the true water table?
  - Is depth to groundwater contoured using groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape? This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide much more accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make. It is better to assume that water

surface elevations are constant in between wells, and then calculate depth to groundwater using a DEM of the land surface to contour depth to groundwater.

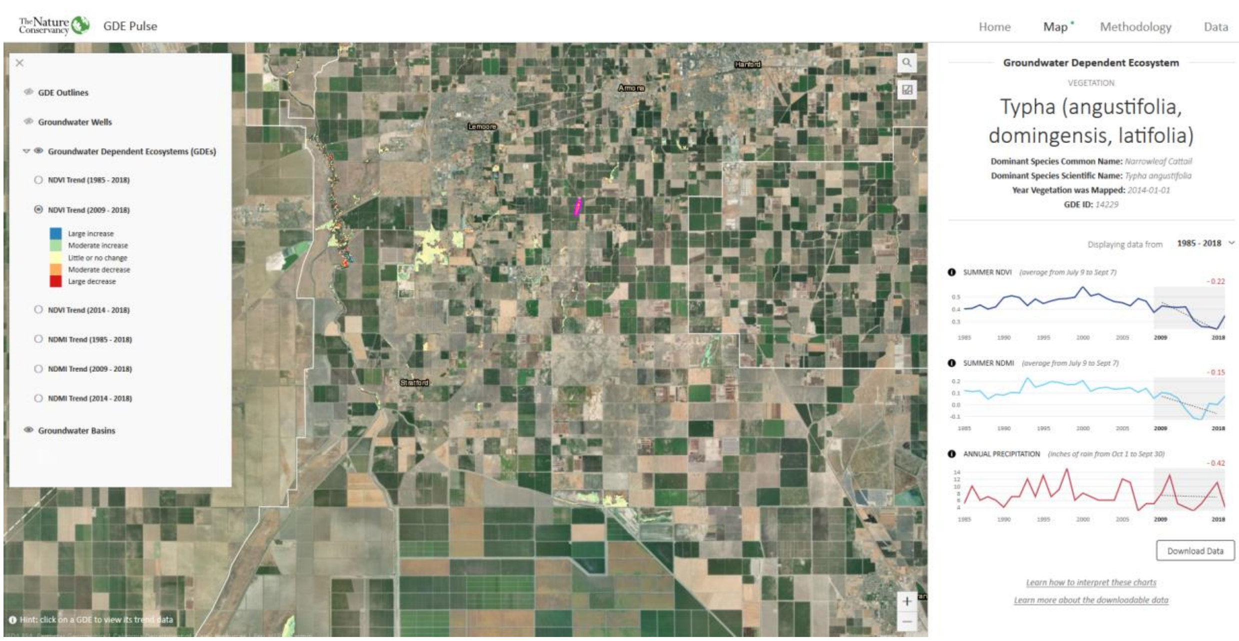
  - Groundwater requirements of GDEs vary with vegetation types and rooting depths. In identifying GDEs, care should be taken to consider rooting depths of vegetation. **Please indicate what vegetation is present in the potential GDEs, and whether the GDE was eliminated or retained based solely on a specified depth limit.** While Valley Oak (*Quercus lobata*) have been observed to have a maximum rooting depth of ~24 feet (https://groundwaterresourcehub.org/gde-tools/gde-rooting-depths-database-for-gdes/), rooting depths vary spatially and temporally based on local hydrologic conditions. Also, maximum rooting depths do not take capillary action into consideration, which will vary with soil type and is an important consideration since woody phreatophytes generally do not prefer to have their roots submerged in groundwater for extended periods of time, and hence effectively redistribute their root systems to straddle the water table as it fluctuates. Hence, many riparian, floodplain and desert ecosystem species are highly capable of accessing groundwater at much deeper depths when needed.
  - Rohde, Froend and Howard (2017) acknowledged GDEs as ecosystems that can rely on groundwater for <u>some or all</u> their requirements. This publication can be found at: https://ngwa.onlinelibrary.wiley.com/doi/pdf/10.1111/gwat.12511. GDEs can rely on multiple water sources simultaneously and at different temporal and / or spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow). SGMA (Section 351.0) defines GDEs as "ecological communities and species that depend on groundwater <u>emerging from aquifers</u> or on groundwater <u>occurring near</u> the ground surface". **Hence, we recommend using depth to groundwater contour maps derived from subtracting groundwater levels from a DEM, as described above, to identify whether a connection to groundwater exists for the wetlands mapped in Figure 3-38 in the Subbasin. Please refer to Attachments D and E of this letter for best practices for using local groundwater data to 1) verify whether polygons in the NC Dataset are supported by groundwater in an aquifer, and 2) verify ecosystem decline or recovery is correlated with groundwater levels.**

- *[Minor changes to the GSP text do not adequately address our comment. Text in red was removed from the Final GSP.]* The GSP states (p. 3-36), "Most of these vegetation types/plant species [identified in the NCCGA] are associated with riparian habitat that rely on surface water", and goes on to disregard them because they are primarily located on the perched areas above the A-Clay layer and the " *A-Clay is not directly interconnected with the underlying unconfined / semi-confined aquifer*". Section 354.16 of the California Code of Regulations states that "each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes…GDEs”. Just because GDEs are <u>thought</u> to rely on surface water and the perched areas are <u>thought</u> to not be <u>directly</u> connected to the unconfined aquifer, does not make them insignificant to the environment. Many data gaps exist that could clarify these statements, for example: 1) indirect and direct connection of perched aquifers have not been fully characterized, 2) the location and extent of perched areas have not been fully characterized, and 3) species composition and potential max rooting depths have not be tabulated. Many rare and protected species reside in GDEs since they are very unique ecosystems. **Please provide further information on the analysis of GDEs and potential ISWs, including citing field studies or modeling studies that show the hydrologic nature of these systems. Specifically indicate 1) which streams and GDE polygons were excluded, 2) identify any data gaps, and 3) ensure that GDE polygons are <u>retained until data gaps are reconciled</u>.**

<u>Checklist Items 16 to 20 - Describing GDEs (23 CCR §354.16)</u>

[Section 3.2.8.1 Groundwater Dependent Ecosystems (GDEs) (p. 3-35 to 3-37)]

- *[Minor changes to the GSP text do not adequately address our comment.]* **Please provide information on the historical or current groundwater conditions specifically near the GDEs or the ecological conditions present**. **If data gaps exist, please acknowledge them and state how they may be reconciled in the future.** Refer to GDE Pulse (https://gde.codefornature.org; See Attachment E of this letter for more details) or any other locally available data (e.g., leaf area index, evapotranspiration or other data) to describe depth to groundwater trends in and around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in the Tulare Lake GSP Area.



- *[Minor changes to the GSP text do not adequately address our comment.]* **Please provide an ecological inventory (see Appendix III, Worksheet 2 of the GDE Guidance) for all potential GDEs that includes vegetation or habitat types and rank the GDEs as having a high, moderate or low value. Explain how each rank was characterized.**
- *[Minor changes to the GSP text do not adequately address our comment.]* **Please identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat were found in or near any of the GDEs since some organisms rely on uplands and wetlands during different stages of their lifecycle**. Resources for this include the list of freshwater species located in the Subbasin that can be found in Attachment C of this letter, the Critical Species Lookbook, and the USFWS's ECOS and CDFW's CNDDB databases / mapping tools.

Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)

[Section 3.3.1.2 Outflows (pp. 3-39 to 3-40)]

- *[Minor changes to the GSP text do not adequately address our comment.]* Evapotranspiration (ET) is included as an outflow category in the water budget; however, it is only included as it pertains to crop water requirements. Groundwater outflow to the ET of natural ecosystems (i.e., GDEs, riparian areas, etc.) should be identified as a groundwater budget component. If the outflow is not known, it should be identified as a data gap and provisional information should be provided until an analysis can be performed to address the data gap. **Since natural ecosystems may be beneficial users of groundwater: 1) please provide a breakdown of ET for all land-cover types, including native and riparian vegetation (such as wetlands, riparian vegetation, phreatophytes and other communities); 2) identify any data gaps; 3) outline the actions needed to address them; 4) and the schedule for their implementation.**

Checklist Item 23-26 Sustainability Goal (23 CCR §354.24)

[Section 4.0 Sustainable Management Criteria (p. 4-1)]

- *[Minor changes to the GSP text do not adequately address our comment.]* The GSP states that there is no ISW connectivity within the entire Subbasin, but data to support this broad assertion are insufficient to dismiss this sustainability indicator. It is acknowledged earlier in the GSP that recharge primarily occurs through surface streams / rivers and unlined canals; however, there isn't any quantitative analysis, monitoring data, or other information provided to support that ISWs are not present, and statements within the GSP are contradictory. **Please address ISWs in the Sustainable Management Criteria and the Sustainability Goal until sufficient data is available to conclude the status of ISWs.**
- *[Minor changes to the GSP text do not adequately address our comment.]* The GSP states "Indicators for the sustainable management of groundwater were determined by SGMA based on factors that have the potential to impact the health and general

well-being of the public." This chapter starts off by disregarding the environmental use and users of groundwater. Sweeping statements like this should be modified throughout the chapter to acknowledge all beneficial users. **Since GDEs and ISWs may be present in and near the GSP area due to the prevalence of shallow groundwater (please see comments under Checklist Items 16-20) they should be explicitly recognized in the establishment of sustainable management criteria for the groundwater level decline and ISW sustainability indicators. Please also update this section to recognize environmental beneficial groundwater uses as a component of the sustainable management goals.**

[Section 4.1 Sustainability Goal (pp. 4-1 to 4-3)]

- *[Our comment was not addressed in the GSP. No changes to the GSP text were made.]* The Sustainability Goal states that "…the sustainability goal works as a tool for managing groundwater, basin-wide, on a long-term basis to protect quality of life through the continuation of existing economic industries in the area, including but not limited to agriculture". The overall theme is to protect groundwater resources for developed water users, particularly agriculture. **The narrative discussion of the sustainability goal should be expanded to include other beneficial uses and users of groundwater including environmental uses and users of groundwater.**
- *[Minor changes to the GSP text do not adequately address our comment.]* The Discussion of Measures states that "management actions will be implemented to help mitigate overdraft based on the demand from beneficial uses and users", but developed users are the only parties identified in this chapter. Criteria used to evaluate the priority given to beneficial users during overdraft periods is not described. **Please update this section to provide a discussion of how human and environmental beneficial uses will be balanced in the implementation of management actions during periods of drought and overdraft.**
- *[Minor changes to the GSP text do not adequately address our comment.]* **Since GDEs and ISWs may be present in the Subbasin (please see comments under Checklist Items 16-20) they should be recognized as beneficial users of groundwater and should be included in the Sustainability Goal and Discussion of Measures. In addition, a statement about any intention to address pre-SGMA impacts should be included.**
- *[Minor changes to the GSP text do not adequately address our comment.]* GDEs are dependent, in part, on suitable water quality; however, the GSP focuses on subsidence, groundwater levels and changes in groundwater storage; and only considers water quality for irrigation and domestic use. **Given that there are potential GDEs and ISWs in the Subbasin, and they may be affected by water quality they should be included in the Sustainability Goal and addressed in the Sustainable Management Criteria established for the Water Quality Sustainability Indicator.**

[Section 4.2.4 Groundwater Quality Indicator (pp. 4-11)]

- *[Minor changes to the GSP text do not adequately address our comment.]* The GSP states that the GSAs will rely on the existing programs in place for monitoring groundwater quality, and the "local GSAs will focus on water quality issues that are related to groundwater pumping rather than on issues related to contamination". However, since much of the groundwater is being used for irrigation, which then leaches back into the soil or drains elsewhere and carries nutrients and other solutes with it, the GSA should monitor constituents related to agriculture in addition to those related to pumping, such as arsenic. This includes nitrates, phosphates, salts, sodium, boron, chloride and acidification from carbonic acid which affects soil biota, structure, geochemistry, GDEs and ISWs. **Please consider revising this section to include monitoring for agricultural constituents.**

Checklist Item 26 – Measurable Objectives (23 CCR §354.30)

[Section 4.4 Measurable Objectives (pp. 4-19 to 4-23)]

- *[Minor changes to the GSP text do not adequately address our comment.]* This Measurable Objectives do not consider the water quality needs of GDEs and ISWs. **Please modify this section to include impacts from degraded water quality on the plant and wildlife communities, and species they support within these habitats**.
- *[Minor changes to the GSP text do not adequately address our comment.]* This GSP states that "ISWs do not exist within the Subbasin". However, this conclusion was based on well groundwater levels that are not reasonably close to the drainages, shallow or nested monitoring wells to assess potential interaction with surface water and GDEs and connectivity to underlying aquifers, or hydrogeologic data that does not fully characterize the location and extent of perched and shallow zones within the upper aquifer. In addition, there are no supporting data and information that demonstrates shallow groundwater near the streams and rivers is not supporting ISWs or GDEs. As such, the data are insufficient to dismiss this sustainability indicator under the GSP regulations. **Please modify this section of the GSP to retain ISWs as a sustainability indicator, pending the characterization of the shallow / perched zones and analysis of monitoring data or monitoring from additional wells to be installed in the future.**
- *[Minor changes to the GSP text do not adequately address our comment.]* Since there are wildlife refuges and protected wildlife area that contain critical habitat directly adjacent to the GSP area, the GSP needs to address these areas, whether there are potential GDEs or ISWs, and how management actions within the Subbasin would affect these sensitive habitats. **Please explain how the measurable objectives will benefit adjacent subbasins and not hinder the ability of adjacent subbasins to be sustainable; and how the measurable objectives would benefit adjacent critical habitat areas. What are the mechanisms for this benefit?**
- *[Minor changes to the GSP text do not adequately address our comment.]* Sweeping statements, such as (p. 4-20) "interconnected surface waters do not exist within the Subbasin, so this indicator will not be further discussed in terms of Measurable Objectives" are completely dismissive with disregard for data gaps. There is not

enough evidence to make statements like these. Many of the wells are screened too deep, not in the proper location to make comparisons, and / or nested wells have not been installed to inform how shallow groundwater interacts with potential ISWs, GDEs or the unconfined aquifer. **Please include all potential ISWs in the analysis and develop measurable objectives and minimum thresholds for these, to be managed until data gaps prove they are not interconnected.**

Checklist Item 27-29 – Minimum Thresholds (23 CCR §354.28)

[Section 4.3.1.2 Description of Minimum Thresholds and Processes to Establish [for Groundwater Level Indicator (p. 4-13), and Section 4.3.1.4 Description of Minimum Thresholds and Processes to Establish [for Groundwater Quality Indicator (p. 4-15)] *[This Section was removed from the GSP: Section 4.4.1.5 Description of Minimum Thresholds and Processes to Establish [for Interconnected Surface Water Intrusion (p. 4-14)]*

- *[Minor changes to the GSP text do not adequately address our comment.]* These Minimum Thresholds do not consider GDEs and ISWs. **Please include GDEs (see comments under checklist items 8-20) in this section and whether the minimum thresholds and interim milestones will help achieve the potential sustainability goal as it pertains to the environment.**
- *[Minor changes to the GSP text do not adequately address out comment. The quoted GSP text from our original comment below was removed from the Final GSP, but TNC's bolded requests were not adequately addressed.] Section 4.4.1.5 (p. 4-14) states that "Interconnected surfaces waters are not considered present in the Subbasin; therefore, no further discussion will occur on this indictor in terms of MTs".* The GSP fails to provide any monitoring data, analysis or other information to dismiss ISW in the basin. Based on the inconsistencies in groundwater levels presented previously in the GSP and this letter, and the unknowns associated with the extent and location of shallow and/or perched zones in the upper aquifer, it is possible that rivers, streams and GDEs may be hydraulically connected to the regional aquifer system. Minimum thresholds must be established for ISWs and GDEs unless and until sufficient data are provided to eliminate them from consideration. **Please modify this section of the GSP to 1) develop minimum thresholds for possible ISWs, including GDEs, and 2) include a statement that a data gap exists related to the interconnectedness of the of the Tulare Lakebed, rivers / streams, and shallow groundwater zones.**

[Section 4.3.4 Potential Effects to Beneficial Uses and Users (p. 4-18 to 4-19)]

- *[Minor changes to the GSP text do not adequately address our comment.]* The evaluation of minimum thresholds completely disregards consideration of environmental beneficial users, such as ISWs, GDEs or the species they support. Effects to beneficial uses and users is focused on well capacity, pumping costs, extraction, and impacts from subsidence on infrastructure. There is no mention about potential impacts to GDEs or ISWs that could be affected by lowering of the shallow portions of the unconfined or semi-confined portions of the upper aquifer since a continuity / discontinuity between the two is a data gap. Although there are many data gaps associated with ISWs and GDEs, it must be assumed that potential significant and unreasonable impacts to these beneficial users could occur. As such, they should be addressed in the evaluation of minimum thresholds. Section 4.3.4 should be modified to address how potential ISWs and GDEs would be affected by further lowering of groundwater levels. **Please address how 1) potential ISWs and GDEs would be affected by further lowering of groundwater levels, 2) these beneficial users will be protected / managed in the interim until data gaps are filled, and 3) what measures will be employed to protect GDEs and ISWs that are confirmed after data gaps are filled.**

- *[Minor changes to the GSP text do not adequately address our comment.]* This Section does not include the required analysis of how the selected minimum thresholds for decline in groundwater levels could affect potential ISWs and GDEs within and near the GSP area. **Please include an analysis of the potential effect of the established minimum thresholds on ISWs and GDES within and near the GSP area, particularly in adjacent wildlife preserves / refuges.**
- *[Minor changes to the GSP text do not adequately address our comment.]* Although agricultural and domestic water quality concerns have been articulated, similar concerns were not identified for environmental users. Degradation of water quality can impact terrestrial and aquatic wildlife that live in or near these ecosystems during at least part of the year even if the water is not a concern from an agricultural or municipal standpoint. **Please include a discussion about GDEs and water quality and whether the minimum thresholds and interim milestones will help achieve sustainability for environmental users.**

Checklist Item 30-46 – Undesirable Results (23 CCR §354.26)

[Section 4.2 Undesirable Results (pp. 4-6 to 4-12), and Subsection 4.3.3 Potential Effects to Beneficial Uses and Users (pp. 4-11 to 4-12)]

- *[Minor changes to the GSP text do not adequately address our comment.]* The GSP states that there are no ISWs; however, this is largely based on assumptions and there are no monitoring data, analyses or other information to support this statement. In addition, the GSP indicates that 1) streams and rivers are the primary source of recharge; 2) a connection may exist between shallow and perched groundwater, but the extent and location of perched groundwater is unknown; and 3) surface and groundwater may be periodically connected in Tulare Lake. Furthermore, GDEs may exist within and near the GSP area. This is a data gap that needs to be identified and rectified by employing a monitoring network to verify the status of ISWs prior to complete dismissal of ISWs from the GSP. **Please modify this section of the GSP to include:**
    1) **A statement that there are potential ISWs and GDEs, unless adequate data can be provided to dismiss them.**
    2) **An assessment of the nature of potential undesirable results to ISWs and GDEs.**
    3) **A statement that the aquifers will be managed such there will be no depletion of ISWs that results in a significant and unreasonable impacts to ISWs or GDEs.**

4) **Data gaps and specific steps to verify the presence or absence of ISWs and GDEs with monitoring wells screened at the appropriate depths.**

- *[Minor changes to the GSP text do not adequately address our comment.]* This section only describes undesirable results relating to human beneficial uses of groundwater and neglects environmental beneficial uses / users that could be adversely affected by chronic groundwater level decline or depletion of ISWs. **Please add "possible adverse impacts to potential GDEs and ISWs" to the list of potential undesirable results.**
- *[Minor changes to the GSP text do not adequately address our comment.]* The GDE Pulse web application developed by TNC provides easy access to 35 years of satellite data to view trends of vegetation metrics, groundwater depth (where available), and precipitation data. This satellite imagery can be used to observe trends for NC dataset polygons within and near the GSA. Over the past 10 years (2009-2018), some NC dataset vegetation polygons have experienced adverse impacts to vegetation growth and moisture. An example screen shot of GDEs near Lemoore, California from the GDE Pulse tool is presented under Checklist items 16 to 20 above.
    - **For each potential GDE unit with supporting hydrological datasets please include the following:**
        - Plot and provide hydrological datasets for each GDE.
        - Define the baseline period in the hydrologic data.
        - Classify GDE units as having high, moderate, or low susceptibility to changes in groundwater.
        - Explore cause-and-effect relationships between groundwater changes and GDEs.
    - **For each identifiable GDE unit without supporting hydrological datasets please describe data gaps and / or insufficiencies.**
    - **Compile and synthesize biological data from CDFW's CNDDB, USFWS' ECOS Mapper, NC dataset, and / or the GDE Pulse tool (as applicable) for each GDE unit by:**
        - Characterizing biological resources for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.
        - Describing data gaps / insufficiencies.
    - **Describe possible effects on potential ISWs, GDEs, land uses, and property interests, including:**
        - Cause-and-effect relationships between potential ISWs and GDEs with groundwater conditions.
        - Impacts to potential ISWs and GDEs that are considered to be "significant and unreasonable".
        - Report known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities.
        - Land uses should include recreational uses (e.g., fishing/hunting, hiking, boating).

        - Property interests should include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.
- *[Minor changes to the GSP text do not adequately address our comment.]* This section discusses water quality with respect to agricultural and municipal use but does not include a discussion of potential undesirable results for GDEs and ISWs. **Please modify this section to specifically address how degraded water quality could affect vegetation and wildlife species that relay on GDEs and ISWs. Although arsenic is mentioned in this GSP, please consider adding a statement that over-pumping and dewatering of aquitards has been identified as a potential source of elevated arsenic concentrations above drinking water standards in San Joaquin Valley aquifers.** The following is a link to a paper by Smith, Knight and Fendorf (2018) titled "Overpumping leads to California groundwater arsenic threat": https://www.nature.com/articles/s41467-018-04475-3

Checklist Items 47-49 – Monitoring Network (23 CCR §354.34)

[Chapter 5 Monitoring Network (pp. 5-1 to 5-3), and Section 5.1 Description of Monitoring Network (pp. 5-3 to 5-13)]

- *[Minor changes to the GSP text do not adequately address our comment.]* The GSP describes groundwater monitoring locations and states that groundwater monitoring in areas de-designated by the Tulare Lake Basin Plan amendment and associated aquifer zones is not proposed as decided by the GSAs. Although these areas (designated Management Area A and B) are not designated for municipal and agricultural uses in the Basin Plan, the groundwater could still potentially be used or is being used for livestock, crops with a higher tolerance to salt, domestic supply, public supply, and potentially other uses in the future. Since it is currently unclear how withdrawals within the unconfined aquifer will affect the perched and shallow areas of the aquifer (as associated with the A-Clay and C-Clay layers), Management Areas A and B still need to be monitored to assess effects to the unconfined aquifer as a whole. As stated above in the comments for other Checklist Items, **please reconcile data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells, GDE and ISW responses to groundwater levels) along rivers, creek and the Tulare Lakebed in this section of the GSP to improve ISW and GDE mapping in future GSPs**.
- *[Minor changes to the GSP text do not adequately address our comment.]* It is not acceptable to completely disregard these Management Areas based purely on a de-designation from municipal and agricultural uses only when there are still current and potential environmental uses of this groundwater. In addition, there is much uncertainty how the shallow aquifers are interacting with GDEs and ISWs. **Please add Representative Monitoring Sites (RMS) for these areas in order to better understand the interaction of the A-Clay and C-Clay layers with the unconfined aquifer, and potential GDEs and ISWs.**
- *[Minor changes to the GSP text do not adequately address our comment.]* This section lists the proposed facilities for monitoring groundwater levels, storage and

quality, and subsidence on pp. 5-8 through 5-13. This section proposes to use groundwater level monitoring to assess potential groundwater level and storage declines, existing programs to monitor water quality, and monitored surface conditions to evaluate land subsidence. It may acceptable to use groundwater level [in combination with assessment of vegetation response, for example by remote sensing] as a proxy for assessing potential effects on ISWs and GDEs, but the data gaps associated with the A-Clay, C-Clay, and shallow water tables need to be addressed. A set of representative wells have been selected to monitor the upper and lower aquifer (Figures 5-1 to 5-3). There are only five wells that represent the "Above A-Clay and Shallow Groundwater Levels (i.e., Zone A)", and there are three data gaps areas identified (Figure 5-1). **Please describe 1) how these five wells are considered representative of the entire GSP Area, 2) how those data gap areas were selected, and 3) what methodologies would be used to extrapolate results to other areas where there are no wells or identified data gaps.**

- *[Minor changes to the GSP text do not adequately address our comment.]* Many of the monitoring wells are not screened in the upper portion of the unconfined aquifer, where environmental beneficial users would obtain the groundwater on which they rely. Finally, there are currently no plans to monitor groundwater level declines to assess the potential for significant and unreasonable impacts to ISWs or GDEs in response to groundwater level declines. **Please modify the description of the new well network in the Proposed Facilities Section (Sections 5.1.4, p. 5-8) and Groundwater Levels Section (Section 5.1.5, p.5-8 to 5-10) to provide methodologies, data and other information to support the monitoring of GDEs and ISWs so as to assess and prevent potential significant and unreasonable impacts. This modification should include 1) locating new wells that are appropriately screened to detect connectivity of GDEs and ISWs with the unconfined aquifer and 2) identifying or installing additional stream gages in areas where there is potential for ISWs and GDEs. In addition, monitoring GDE responses to groundwater level declines should be included. GDE Pulse represents an example of how remote sensing can be used to achieve this objective. Please expand on the discussion of how the new well, stream and other data will be used to improve ISW mapping and inform an adequate analysis, and how the data will be used to verify possible GDEs and their sensitivity to groundwater level declines.**

[Section 5.1.1 Monitoring Network Objectives (p. 5-5)]

- *[Minor changes to the GSP text do not adequately address our comment.]* The monitoring objectives listed include developing data to evaluate impacts to beneficial uses and users of groundwater but does not include filling data gaps as they specifically pertain to environmental users of groundwater. **Please expand this list to include monitoring to inform data gaps associated with groundwater use by potential GDEs, ISWs and the species that they support.**

[Section 5.4.1.4 Site Selection (p. 5-21)]

- *[Minor changes to the GSP text do not adequately address our comment.]* This section includes the scientific rationale for the groundwater level monitoring network and the rationale used to add new wells to the monitoring system. However, evaluation and monitoring of potential GDEs and ISWs were not considered in new well site selection. **Please modify the site selection criteria to include the potential to install new wells that will provide information to support the investigation of GDEs and ISWs. This modification should include locating new / existing wells that are appropriately screened to detect connectivity of GDEs and ISWs with the shallow zones of the unconfined aquifer, and 2) expanding information on the extent and location of shallow / perched areas within the unconfined aquifer.**

[Section 5.5 Data Storage and Reporting (pp. 5-28 to 5-29)]

- *[Minor changes to the GSP text do not adequately address our comment.]* The data management system (DMS) described in this section allows for upload and storage of information related to the development and implementation of the GSP. The types of information that will be stored in the DMS are listed. Other than groundwater elevations, quality, and site information, there is no information being stored specific to the monitoring and evaluation of GDEs or ISWs. **We recommend adding remote sensing information to this list to evaluate possible correlations of ecosystem response to potential declines in groundwater level or quality due to pumping. This can be accomplished by incorporating the GDE pulse tool, Sentinel data, evapotranspiration, or leaf area index.**

<u>Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)</u>

[Chapter 6 Projects and Management Actions to Achieve Sustainability (pp. 6-1 to 6-20)]

- *[Minor changes to the GSP text do not adequately address our comment.]* **This chapter should identify the specific actions and schedules proposed to address data gaps in the hydrogeologic conceptual model, water budget and monitoring network.**

[Section 6.3 Projects (pp. 6-5 to 6-17)]

- *[Minor changes to the GSP text do not adequately address our comment.]* This section identifies many important types of projects, including conveyance facilities modifications and construction of new facilities, above-ground surface water storage, intentional recharge basins, on-farm recharge, and aquifer storage and recovery through injection. However, the descriptions of Measurable Objectives for these projects only identifies benefits to water level and storage through changes in allocation, imports, surface water diversions, pumping allowances; and adding recharge projects or water banking. Since maintenance or recovery of groundwater levels, or construction of recharge facilities, may have potential environmental benefits it would be advantageous to demonstrate multiple benefits from a funding and prioritization perspective.

- **For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.**
- If ISWs will not be adequately protected by those listed, **please include and describe additional management actions and projects targeted for protecting potential ISWs.**
- Storage and recharge projects can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such facilities have been incorporated into local HCPs and NCCPs, more fully recognizing the value of the habitat that they provide and the species they support. On-farm recharge may benefit waterfowl during migration, and recreational hunting and birdwatching depending on the time of year that fields are flooded. For recharge projects, **please consider identifying if there is habitat value incorporated into the design and how the recharge ponds can be managed as multiple-benefit projects to benefit environmental users. Grant and funding opportunities for SGMA-related work may be available for multi-benefit projects that can address water quantity as well as provide environmental benefits. Please include environmental benefits and multiple benefits as criteria for assessing project priorities.**
- The GSP states that recharged water typically remains in the unconfined aquifer, above the A-Clay, C-Clay and E-Clay; and that existing wells in the area will be used for extraction of stored water. There appear to be many unknowns as to the extent and location of perched and shallow areas in the unconfined aquifer, and the connectivity of those areas with the aquifer. In addition, there are currently only five wells that will be used to monitor shallow zones throughout the entire GSP area. There remains a fair amount of uncertainty as to how this would operate or affect potential GDEs and ISWs. **Please acknowledge these uncertainties and address 1) how these recharge operations could affect environmental beneficial users, 2) how ecosystems that could be affected by recharge in the unconfined aquifer, particularly above the A- and C-Clay layers will be monitored if there are only five wells.**
- For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

[Section 6.5 GSA Sustainable Methods (pp. 6-19 to 6-20)]

- *[Minor changes to the GSP text do not adequately address our comment.]* The Subbasin potentially includes GDEs and ISWs (see our comments under Checklist Items 8-10 and 16-20 above) that are beneficial uses and users of groundwater and may include sensitive and protected resources. Protection of these environmental users and uses should be considered in establishing project priorities. In addition, and consistent with existing grant and funding guidelines for SGMA-related work, **priority should be given to multi-benefit projects that can address water quantity and quality as well as providing environmental benefits or benefits to disadvantaged communities.**

Attachment C

Freshwater Species Located in the Tulare Lake Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located within the Tulare Lake Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[3]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[4] as well as on TNC's science website[5].

		Legally Protected Status		
Scientific Name	**Common Name**	**Federal**	**State**	**Other**
		BIRDS		
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	BCC	SSC	BSSC - First priority, BLM
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		SSC	BSSC - Third priority
Aythya collaris	Ring-necked Duck			

[3] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[4] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[5] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		SSC	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		SSC	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Dendrocygna bicolor	Fulvous Whistling-Duck		SSC	BSSC - First priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	BCC	Endangered	USFS
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Grus canadensis	Sandhill Crane			
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		SSC	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			

Pelecanus erythrorhynchos	American White Pelican		SSC	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		SSC	BSSC - Third priority
CRUSTACEANS				
Branchinecta lindahli	Versatile Fairy Shrimp			
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		SSC	ARSSC, BLM, USFS
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	SSC	ARSSC, BLM
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS AND OTHER INVERTEBRATES				
Ameletus amador	A Mayfly			
Ameletus spp.	Ameletus spp.			

Anax walsinghami	Giant Green Darner			
Archilestes californica	California Spreadwing			
Argia emma	Emma's Dancer			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Caudatella columbiella				Not on any status lists
Caudatella spp.	Caudatella spp.			
Cinygmula gartrelli	A Mayfly			
Cinygmula spp.	Cinygmula spp.			
Doroneuria baumanni	Cascades Stone			
Drunella coloradensis	A Mayfly			
Drunella doddsii	A Mayfly			
Drunella spinifera	A Mayfly			
Drunella spp.	Drunella spp.			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Epeorus albertae	A Mayfly			
Epeorus spp.	Epeorus spp.			
Ephemerella tibialis	A Mayfly			
Erythemis collocata	Western Pondhawk			
Hetaerina americana	American Rubyspot			
Heterlimnius corpulentus				Not on any status lists
Ischnura barberi	Desert Forktail			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Libellula saturata	Flame Skimmer			
Malenka bifurcata				Not on any status lists
Malenka spp.	Malenka spp.			
Optioservus canus	Pinnacles Optioservus Riffle Beetle		SSC	
Optioservus spp.	Optioservus spp.			
Oroperla barbara	Gilltail Springfly			
Pachydiplax longipennis	Blue Dasher			
Pantala flavescens	Wandering Glider			
Pantala hymenaea	Spot-winged Glider			
Parapsyche almota	A Caddisfly			
Parapsyche elsis	A Caddisfly			

Parapsyche spp.	Parapsyche spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Rhithrogena decora	A Mayfly			
Rhithrogena spp.	Rhithrogena spp.			
Rhyacophila acuminata	A Caddisfly			Not on any status lists
Rhyacophila spp.	Rhyacophila spp.			
Simulium anduzei				Not on any status lists
Simulium spp.	Simulium spp.			
Skwala americana	American Springfly			
Skwala spp.	Skwala spp.			
Sperchon spp.	Sperchon spp.			
Sperchon stellata				Not on any status lists
Sweltsa adamantea				Not on any status lists
Sweltsa spp.	Sweltsa spp.			
Telebasis salva	Desert Firetail			
Tramea lacerata	Black Saddlebags			
Zapada columbiana	Columbian Forestfly			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		SSC	USFS
PLANTS				
Cephalanthus occidentalis	Common Buttonbush			
Cirsium crassicaule	Slough Thistle		SSC	CRPR - 1B.1, BLM
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus squarrosus	Awned Cyperus			
Eragrostis hypnoides	Teal Lovegrass			
Euthamia occidentalis	Western Fragrant Goldenrod			
Galium trifidum	Small Bedstraw			
Juncus effusus effusus	NA			
Lasthenia ferrisiae	Ferris' Goldfields		SSC	CRPR - 4.2

Ludwigia peploides peploides	NA			Not on any status lists
Myosurus minimus	NA			
Persicaria lapathifolia				Not on any status lists
Rorippa palustris palustris	Bog Yellowcress			
Salix gooddingii	Goodding's Willow			
FISHES				
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Cottus asper ssp. 1	Prickly sculpin			Least Concern - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		SSC	Near-Threatened - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus tshawytscha - CV fall	Central Valley fall Chinook salmon	SSC	SSC	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV late fall	Central Valley late fall Chinook salmon	SSC		Endangered - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013

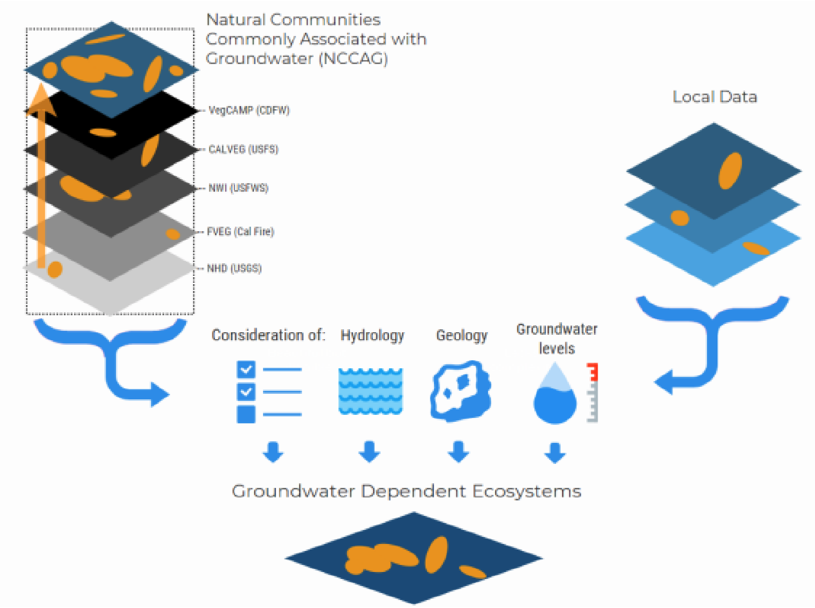
Notes:
ARSSC = At-Risk Species of Special Concern
BCC = Bird of Conservation Concern
BSSC = Bird Species of Special Concern
CRPR = California Rare Plant Rank
CS = Currently Stable
IUCN = International Union for Conservation of Nature
SSC = Species of Special Concern

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[6] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[7]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48

[6] *NC Dataset Online Viewer:* *https://gis.water.ca.gov/app/NCDatasetViewer/*

[7] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[8]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[9] on the Groundwater Resource Hub[10], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[8] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[9] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[10] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

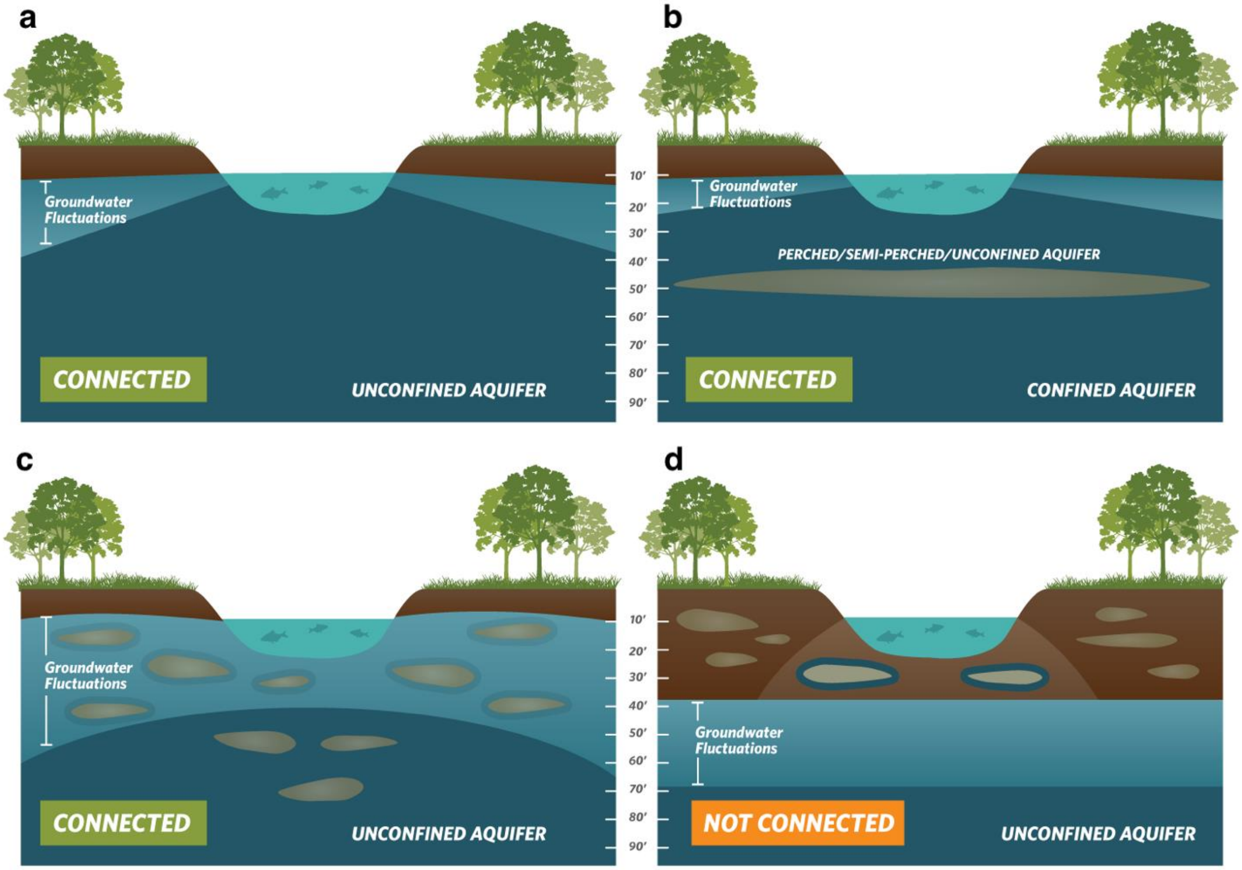

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[11] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[12] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[13] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[14]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network (see Best Practice #6).

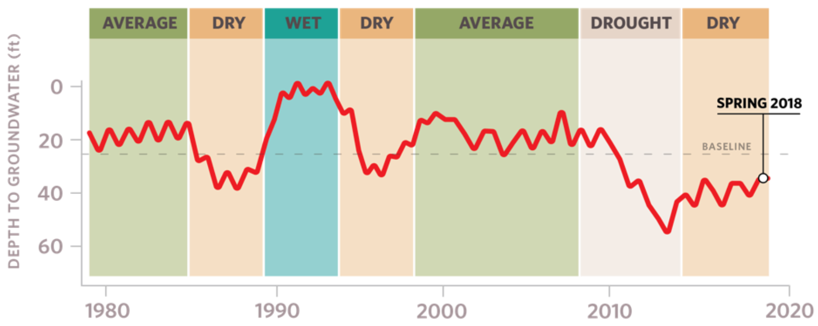

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[11] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[12] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[13] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[14] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[15], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

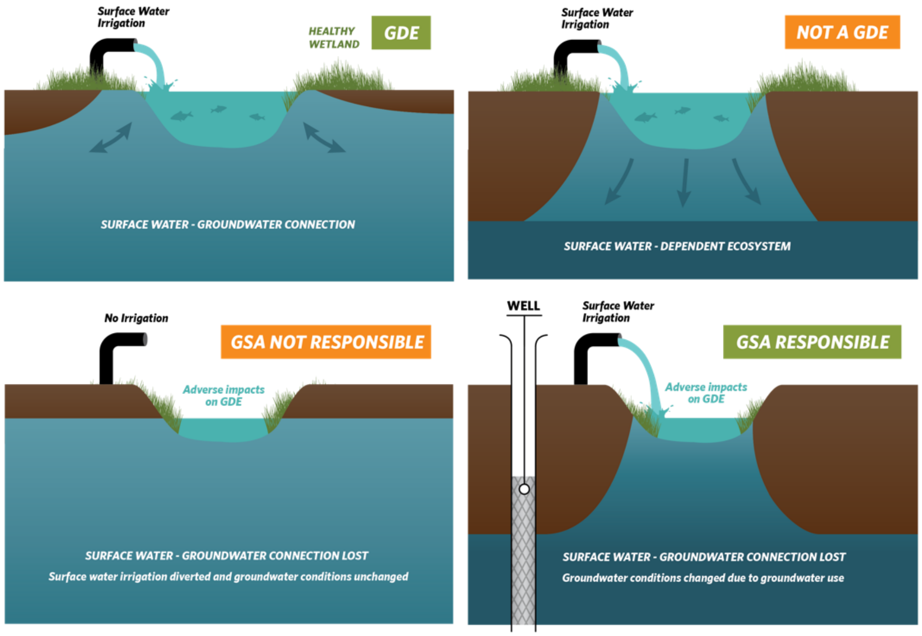

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[15] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

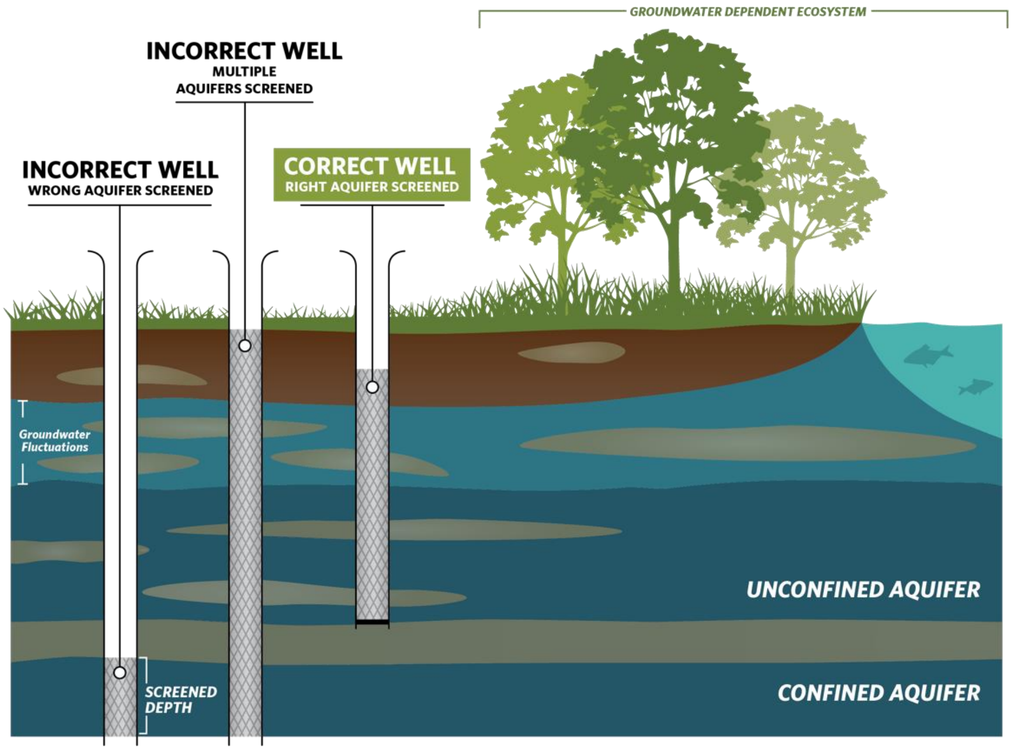

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[16] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

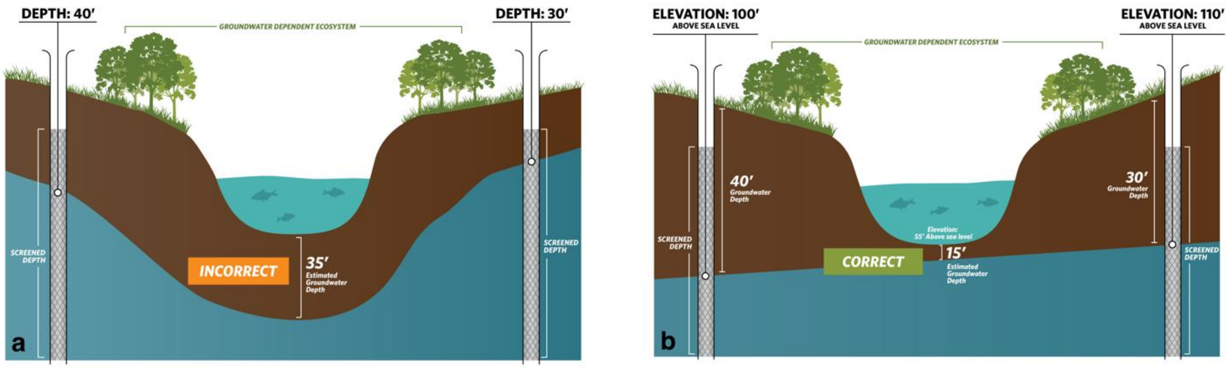

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

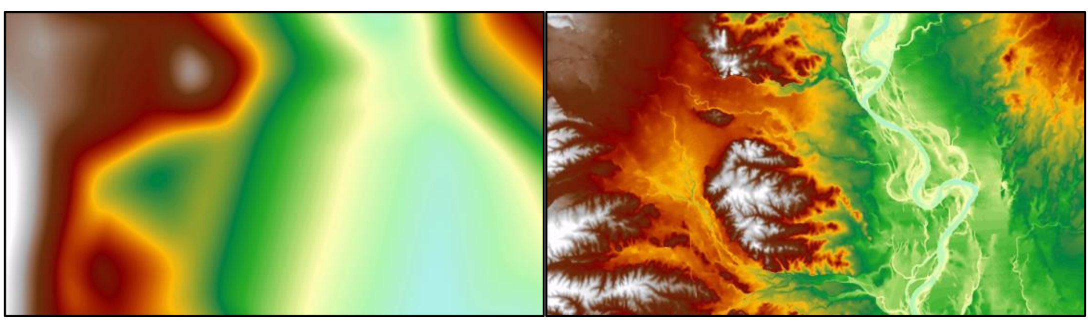

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[16] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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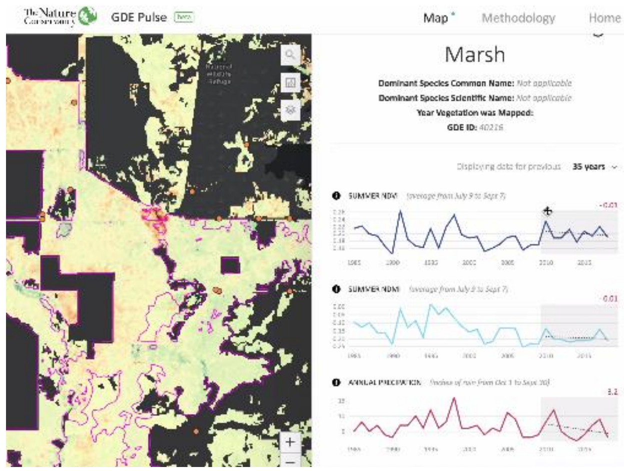
Visit
https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[17]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[18]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

[17] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[18] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

Attachment F
GSA Response to TNC Comments

APPENDIX C – PUBLIC COMMENTS ON THE DRAFT GSP

The Groundwater Sustainability Agencies (GSAs) solicited public and stakeholder comments on the draft Tulare Lake Subbasin (Subbasin) Groundwater Sustainability Plan (GSP) from September 6, 2019, to December 2, 2019. During this period, the GSAs received comments transmitted to them in six letters and in one email. During the Public Hearing on December 2, 2019, one verbal comment was received. This section provides summaries of the comments contained in the letters and email and as presented verbally on the draft GSP and the responses to each comment. Each letter, email, and verbal comment received is listed in Table C-1 and identified by comment author and date received by the GSAs.

Table C-1. List of Commenters

Comment ID	Comment Author	Comment Date
Organizations		
0-1	The Nature Conservancy	November 26, 2019
0-2	California Poultry Federation	November 27, 2019
0-3	Clean Water Action/Clean Water Fund; Local Government Commission; Audubon/California; The Nature Conservancy	December 2, 2019
0-4	Westlands Water District	December 2, 2019
Individuals		
I-1	Colleen Courtney	October 11,2019
I-2	Bill Miguel	October 15,2019
I-3	Bill Toss	December 2, 2019
I-4	Doug Verboon	December 2, 2019

Each of the comments is summarized below followed by responses from the GSAs. Hard copies of the comment correspondence received by the GSAs and a written summary of the verbal comment are compiled and presented following the comments and responses section.

Comment O-1

In The Nature Conservancy's letter to the South Fork Kings (SFK) GSA, they address the GSP's consideration of the beneficial uses and users of groundwater including environmental uses and users. The comment letter states:

Although there is a robust description of the confined (lower) and unconfined/semiconfined (upper) aquifers there is no explicit description with supporting data and information of how groundwater above the A- and C- clays in the upper aquifer interacts with the unconfined aquifer or is influenced by pumping in the unconfined portion of the aquifer. DWR's definition of *a principal aquifer, is defined as an "aquifer of aquifer system that stores, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems." These shallow and perched areas within the upper aquifer range from near surface to 30 feet below ground surface and likely provide water supply to GDEs and ISWs. As such, they yield significant quantities of groundwater to surface water systems and beneficial users, and should not be dismissed because they do not yield groundwater for human use.*

These statements are the basis for the other resulting comments in their letter that request additional data and information, suggest that the GSA's and GSP recognize groundwater dependent ecosystems (GDEs) and interconnected surface water (ISW), and suggest a need for monitoring of these potential areas.

Response: Thank you for your letter and comments. Related to the Hydrologic Conceptual Model as presented in Section 3.1.8 of the draft GSP, there are geologic deposits in the Subbasin that are lacustrine clays named the A- through F-Clays. The A- through D-Clays may be more important locally in restricting the downward movement of groundwater. Figure 3-17 shows the areal extent of the A-Clay and the depth to groundwater above the A-Clay. Comparing this figure with your web-based GDE Pulse indicates an area along the South Fork Kings River where there would be the most interest in evaluating whether GDEs and ISWs occur.

From Section 4.0 of the draft GSP "Indicators for the sustainable management of groundwater were established under Sustainable Groundwater Management Act of 2014 (SGMA) based on factors that have the potential to impact the health and general well-being of the public. The following indicators were evaluated within the Subbasin: groundwater levels, groundwater storage volume, land subsidence, water quality, interconnected surface water, and seawater intrusion." ISW and seawater intrusion are not present within the Subbasin and were omitted from further consideration in the draft GSP. GDEs are not one of the sustainability indicators but rather dependent on ISW systems. Section 3.2.8 describes more fully the conditions found within the plan area.

It is also recognized that the GSP is adaptive in nature and will be updated as more information becomes available. It is noted in Section 5.4.1.2 that the ability to add and/or alter the existing monitor programs is envisioned. The individual GSAs will determine if or when additional attempts will be made to collect that data. Temporal adjustments may be made for the different aquifer zones or in certain areas. For example, semi-annual water level readings in above the AClay wells is probably sufficient to capture seasonal and long-term trends in most of that aquifer zone because water levels in the aquifer are relatively stable in most of the area. Near the Kings River it may be desirable to collect more frequent data from above the A-Clay to better understand the relationship between the river and shallow groundwater.

Attachment G

Mapping Likely Interconnected Surface Water
The Nature Conservancy, California, May 2020

Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, ISW is defined as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:
The groundwater elevation data, available for Spring 2011-2012, and Spring and Fall 2013-2018, comes from the California Department of Water Resources (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). These data are represented as continuous raster layers that approximates "feet above or below mean sea level" based on groundwater well measurements. According to the documentation online, groundwater level measurements were selected based on measurement date and well construction information (where available) and are intended to approximate the groundwater levels in the unconfined to uppermost semi-confined aquifers. Each of the raster layer has a different extent, but all of them are limited to the Central Valley.
To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

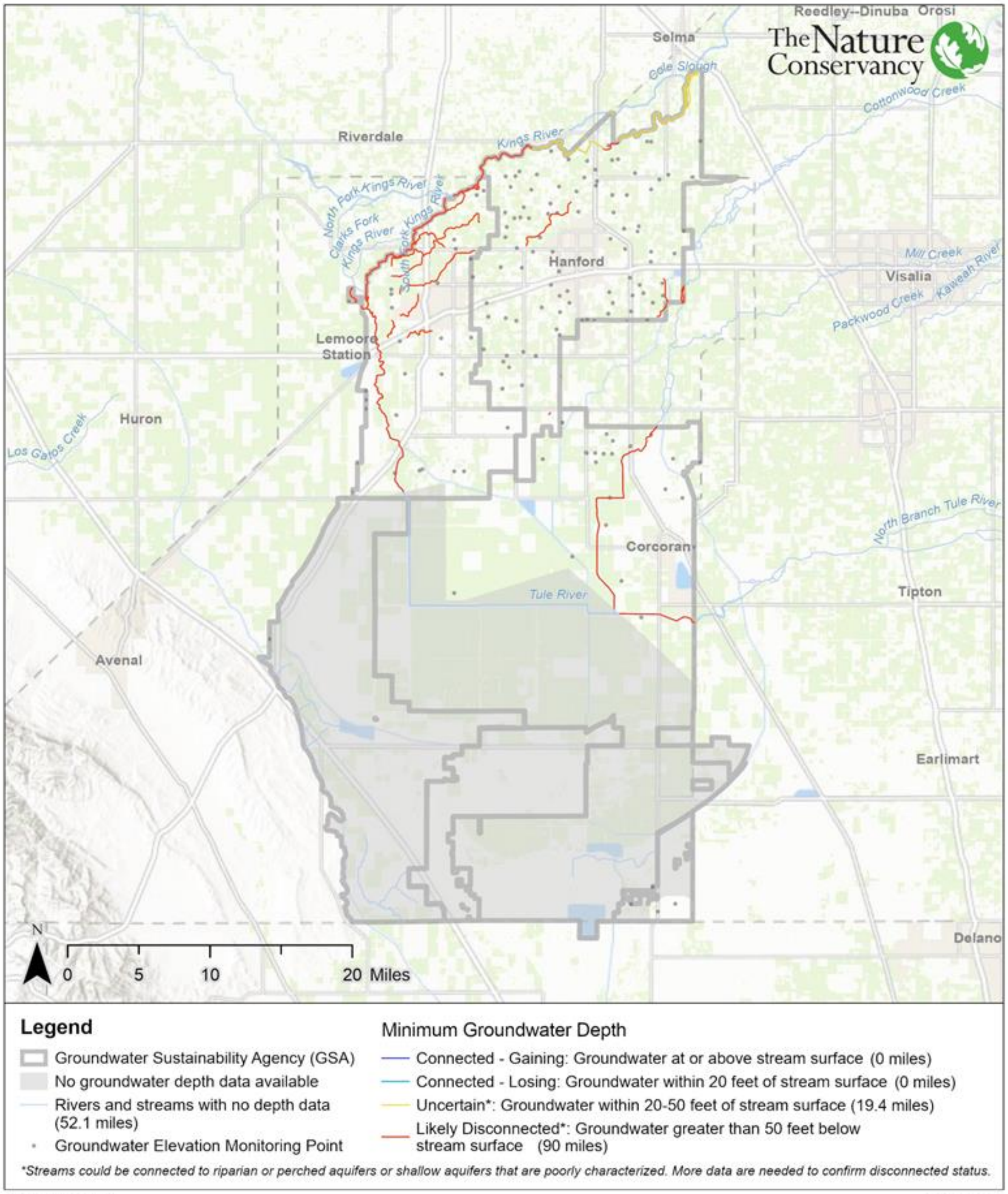
The map splits groundwater depth into four categories:

- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.
- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.

Interconnected Surface Water: Minimum Groundwater Depth (2011-2018)

Tulare Lake Subbasin GSP



5-022.12_TulareLake

Data Sources:
CA Dept. of Water Resources Groundwater Elevation Data, gis.water.ca.gov/app/gicima/
NHD Plus V2 Streams, nhdplus.com/NHDPlus/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[19]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[20]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[21] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[19] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[20] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[21] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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nature.org
GroundwaterResourceHub.org

May 15, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Groundwater Sustainability Plan for the Westside Subbasin

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Groundwater Sustainability Plan (GSP) for the Westside Subbasin prepared for Westlands Water District GSA and Fresno GSA – Westside prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing *sustainable* groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be insufficient in addressing environmental beneficial uses and users.

The identification of environmental beneficial users, as well as their consideration when establishing the sustainability goal, undesirable results and minimum thresholds were insufficient (23 CCR §355.4(b)(4)) and lacked best available science (23 CCR §355.4(b)(1)). In the face of existing, severe overdraft, the GSP would allow groundwater management to largely ignore potential impacts to environmental beneficial users. This could result in irreparable harm to these beneficial users, undermining the intent of SGMA to achieve sustainability.

Many of the gaps in the GSP can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address within 180 days. In these cases, we strongly recommend that the Department, at a minimum, set clear expectations that these be corrected in the 2025 plan update and, to the degree that gaps are due to lack of data, that these data gaps be addressed in time to inform the 2025 update. Should the treatment of environmental beneficial users be indicative of the quality of the overall plan, then we recommend the Department deem the plan inadequate.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C provides a list of the freshwater species located in the Subbasin. Attachment D describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment E provides an overview of a tool (i.e., GDE Pulse) that assesses changes in GDE health using satellite, rainfall, and groundwater data.

Our Key Considerations

Engagement of Environmental Beneficial Users – Stakeholder engagement can best be measured by the degree to which stakeholders are able to influence the plan. TNC provided feedback to the draft GSP, which can be found as a comment attached to the SGMA portal website's GSP Initial Notifications section. We are disappointed to see the feedback that we provided on the draft GSP has been ignored in the final plan. This indicates poor engagement of environmental beneficial users, which undermines the intent of SGMA to ensure that sustainability be defined locally with the participation of all users. Based on our experience the GSP did not "adequately respond to comments that raise credible technical or policy issues with the Plan" (23 CCR §355.4(b)(10)).

TNC recommendation: We strongly recommend that DWR require the GSA to prioritize stakeholder engagement through improvements to their stakeholder engagement plan, partnerships, more representative governance and funding decisions. Because the GSP does not adequately incorporate feedback from environmental beneficial users, we also recommend the GSP revisit all components of the plan where beneficial users must be considered, especially in calculating the water budget and determining undesirable results, minimum thresholds and measurable objectives.

Interconnected Surface Waters (ISWs) – The GSP incorrectly excluded potential and/or actual ISWs because the plan did not employ the best available science. The GSP therefore lacks an assessment of whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water (23 CCR §354.28(c)(6)). The GSP states that there are intermittent streams originating from the Coast Range and moving eastward with very limited stream gaging. In addition, the GSP states that there are no wells screened in the upper 100 feet and there are essentially no wells located near the streams, making it difficult to confirm interconnectivity. Any areas where a lack of shallow groundwater data makes the determination of ISWs uncertain should be identified as potential ISWs rather than being assumed to be disconnected. The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted." "At any point" has both a spatial and temporal component. Even short durations of interconnection between groundwater and surface water can be crucial for surface water flow and support of wetlands.

TNC recommendation: Potential ISWs should be included in the plan until proven disconnected. To help evaluate interconnectivity, TNC recommends obtaining additional shallow groundwater level data, consider installing additional shallow wells, and performing a thorough review of existing information on surface water-groundwater interconnectivity including estimation of the quantity and timing of streamflow depletions in the Subbasin.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 1,294 acres of potential GDEs occur in the GSA boundary. TNC developed the Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

While we were pleased to see that GDEs were identified and mapped, the GSP does not consider GDEs as a beneficial user throughout the plan. While depth to groundwater levels within 30 feet are generally accepted as being a proxy for confirming that polygons in the NC dataset are connected to groundwater, the variable needs of plant species and their dependence on seasonal and inter-annual groundwater level fluctuations should be considered when applying this criterion. It is highly advised that seasonal and interannual fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one point in time or contoured with too few shallow monitoring wells can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs.

<u>TNC recommendation</u>: TNC recommends using the Best Practices for Using the NC Dataset to Identify GDEs under SGMA, which is provided as Attachment D. TNC also recommends that the GSP utilize groundwater levels that represent interannual and inter-seasonal variability along with additional information provided in our BMP guidance document (Attachment D) to identify and consider GDEs in the GSP. Specifically, please ensure that a Digital Elevation Model (DEM) is used when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment D.

Water Budget – We were disappointed to see that the water budget did not include the current, historical and projected demands of native vegetation and/or managed wetlands, as required under SGMA (Emergency Regulations Section 354.18(a) and (b)(3)). The GSP only focused on a subset of water use sectors, such as urban and agricultural users of groundwater. This is problematic because key EBUs of groundwater are not being accounted for as water supply decisions are made using this budget nor will they likely be considered in project and management actions.

<u>TNC recommendation</u>: As required by SGMA, TNC recommends explicit inclusion of all water use sectors in the water budget.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe potential impacts on environmental users of groundwater and or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

<u>TNC recommendation</u>: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.

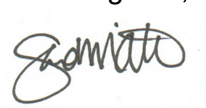
[1] Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

Monitoring Network – We were disappointed to see that the monitoring network does not adequately characterize the interaction of GDEs and other environmental of surface water and groundwater as required by 23 CCR §354.34. The GSP acknowledges groundwater monitoring of data gaps along the western streams, which must be addressed to characterize GDE dependence on shallow groundwater. However, the monitoring program in the final version was not updated to reflect which wells will be used to track groundwater level changes to monitor GDEs. In addition, there was no discussion of how the GDEs will be monitored. Also, the monitoring costs were not updated to reflect the additional activity for monitoring shallow wells for GDEs.

TNC recommendation: TNC recommends that the GSP (1) reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs; (2) characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and (3) determine what ecological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the Subbasin.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but *sustainable* groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,



Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

The Nature Conservancy

Attachment A
Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11
		If NC Dataset *was* used: Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12

The Nature Conservancy

			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	**3.1 Sustainability Goal** *23 CCR §354.24*	**Environmental stakeholders/representatives were consulted.**		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	**Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.**		26
	3.3 Minimum Thresholds *23 CCR §354.28*	**Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:**		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	**For GDEs, hydrological data are compiled and synthesized for each GDE unit:**		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32
			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33

			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

**TNC Evaluation of the
Westside Groundwater Sustainability Plan**

The complete Final GSP for the Westside Subbbasin, adopted December 17, 2019, was reviewed by TNC. TNC submitted comments on the Draft GSP on October 23, 2019. However, specific responses to comments on the Public Draft were not publicly available so we compared the Public Draft GSP to the Final GSP to determine if changes were made to the Final GSP text that addressed TNC's previously submitted comments. This attachment lists our original comments on the complete Public Draft GSP, as submitted to the Westlands Water District during the public comment period, and states whether or not they were addressed in the Final GSP *[as green text in brackets]*. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

[Section 2.1.5.1 Identification of Groundwater Beneficial Uses/Stakeholders (p. 2-17)]

- *[Our comment was not addressed. No changes to GSP text made.]* California Water Code §1305(f) defines that beneficial uses of waters of the State include "preservation and enhancement of fish, wildlife, and other aquatic resources and preserves". Section 2.1.5.1 lists typical users of groundwater, including agricultural, domestic, municipal, the public, agencies, federal government, disadvantaged communities, and environmental users. Environmental users listed were the Pilibos Wildlife Area and the Pleasant Valley Ecological Area. **Please describe whether other beneficial uses and users of groundwater in the Subbasin are present, such as: GDEs; managed wetlands; Protected Lands, including conservation areas and other protected lands; and Public Trust Uses including wildlife, aquatic habitat, fisheries, and recreation.**
- The types and locations of environmental uses, species and habitats supported, and the designated EBUs of surface waters that may be affected by groundwater extraction in the Subbasin should be specified. **Please explicitly identify the environmental users and take particular note of the species with protected status.** The following are resources that can be used:
    - Natural Communities Commonly Associated with Groundwater dataset (NC Dataset) - https://gis.water.ca.gov/app/NCDatasetViewer/
    - The list of freshwater species located in the Westside Subbasin in Attachment C of this letter.
    - The California Department of Fish and Wildlife's California Natural Diversity Database (CNDDB).
    - The United States Fish and Wildlife Service's (USFWS) IPaC report.

Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8)

[Section 2.1 Description of the Plan Area (pp. 2-1 to 2-5)]

- *[Our comment was not addressed. No changes to GSP text made.]* The GSP provides a description of the Central Valley Project and groundwater well density, however there is no discussion of any instream flow requirements, if any, or how the water infrastructure is in compliance with regulatory requirements set to protect species of concern. **Please provide a description of any current and planned instream flow requirements for the westside creeks including Panoche Creek, Cantua Creek, Salt, Martinez, Domengine, the Arroyo Pasajero (Los Gatos and Zapato Chino Creeks). If there are not instream flow requirements in place or planned, then please state that in the document.**

[Section 2.1.6 Land Use Elements or Topic Categories of Applicable General Plans (p. 2-6 to 2-9)]

- [TNC's comments were acknowledged and minor GSP text changes were made; however, the changes did not adequately address our comments.] This section is focused on agriculture and irrigation needs, demands, and types of irrigation. In general, the general plans do seek to protect riparian habitat. This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin and if they are associated with areas with instream flow requirements; or critical, GDE or ISW habitats. **Please identify all relevant HCPs and NCCPs within the Subbasin, and any reaches with instream flow and critical habitat requirements. Please elaborate on the natural resources within the Subbasin and address how GSP implementation will coordinate with the goals of these plans and requirements.**
- The Critical Species Lookbook[2] includes the potential groundwater reliance of critical species in the basin. **Please include a discussion regarding the management of critical species and their habitats for these aquatic ecosystems and its relationship to the GSP.**

[Section 2.1.3.5 General Plan Considerations (p. 2-9)]

- *[Our comment was not addressed. No changes to GSP text made.]* There are no figures that show the proportion of the area covered by city, community, and county general plans. There are two county plans and two city plans that cover the Westlands Water District's area. The GSP should be modified to include a discussion of General Plan goals and policies related to the protection and management of GDEs, ISWs and aquatic resources that could be affected by groundwater withdrawals. **Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs.**

[2] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

[Section 2.1.4.1 County Well Construction, Well Destruction and Abandonment Policies (p. 2-14)]

- *[Our comment was not addressed. No changes to GSP text made.]* Table 2-7 (p. 2-14) summarizes well permitting requirements and county ordinances for the counties of Fresno and Kings. **Please include a discussion of the following in this section:**
  - Future well permitting must be coordinated with the GSP to assure achievement of the Plan's sustainability goals.
  - The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF v. SWRCB and Siskiyou County, No. C083239). **The need for well permitting programs to comply with this requirement should be stated in the text.**

Checklist Items 5 to 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 2.2.3 Hydrogeological Conceptual Model (p. 2-21)]

- *[Our comment was not addressed. No changes to GSP text made.]* Defining the bottom of the Subbasin based on geochemical properties is a suitable approach for defining the base of freshwater, however, as noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** This will prevent the possibility of extractors with wells deeper than the basin boundary (defined by the base of freshwater) from claiming exemption of SGMA due to their well residing outside the vertical extent of the basin boundary. **Please characterize groundwater well extractions from the deepest wells in relation to defining the basin bottom**.

[Section 2.2.1.1 Background Information for Hydrogeologic Model (p. 2-27)]

- *[Our comment was not addressed. No changes to GSP text made.]* Regional basin-wide geologic cross sections are provided in Figures 2-27 through 2-30 (pp. 2-28 to 2-30, Chapter 2 figures). These cross-sections do not include a graphical representation of the manner in which the very shallow groundwater or perched water may interact with ISWs or GDEs that would allow the reader to understand this topic. **Please include example near-surface cross section details that depict the conceptual understanding of shallow groundwater and stream interactions at different locations, including the Shallow Zone, any perched aquifers, and the Upper Aquifer**.
- *[Our comment was not addressed. No changes to GSP text made.]* Much of the referenced information that was relied on for this GSP is pre-1980; however, the water districts and DWR have been closely monitoring the Subbasin. More

information should be presented that represent current, as well as historical conditions. **Please elaborate further on current conditions and how conditions have changed from the historical baseline.**

[Section 2.2.1.6 Identification / Differentiation of Hydrogeologic Units (pp. 2-27 to 2-32)]

- [TNC's comments were acknowledged and minor text changes were made; however, the changes did not adequately address our comments.] Although there is robust description of the Upper and Lower Aquifers there is no explicit description or supporting data and information of how the Shallow Zone of the Upper Aquifer is not influenced by pumping in the Upper Aquifer. DWR's definition of a principal aquifer, is defined as an "aquifer or aquifer system that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems" [*23 CCR §351(aa)*]. The Shallow Zone of the Upper Aquifer may provide water supply to GDEs and ISWs. **Please explicitly state which is the principal aquifer and expand the description of the principal aquifer and aquitards to include the Shallow Zone.**

[Section 2.2.3.6.3 Upper Aquifer (p. 2-30)]

- *[Our comment was not addressed. No changes to GSP text made.]* The Upper Aquifer is overlain by a shallow zone that appears to occasionally be near or at the ground surface. There is a lack of information detailing and describing this shallow zone, and its connection to the Upper Aquifer. **Include a discussion of the relationship between the Shallow Zone and Upper Aquifer and provide cross-sections to show their connectivity and relationship to potential ISWs and GDEs.**

[Section 2.2.4.1.1 Historical Groundwater Levels (pp. 2-34 to 2-35)]

- [TNC's comments were acknowledged and minor text changes were made; however, the changes did not adequately address our comments.] Water surface elevations are shown for select wells for the Upper and Lower Aquifers (Figures 2-33 and 2-34); however, no data is shown that clearly identifies the relationship between the Shallow Zone and Upper Aquifer. **Please identify this as a data gap and explain how this data gap will be filled in the future.**

[Section 2.2.2.3 Subsurface Compaction and Land Subsidence (p. 2-38)]

- *[Our comment was not addressed. No changes to GSP text made.]* The GSP states that "The majority of irrigation water is pumped from the Lower Aquifer due to its greater thickness and because of the better water quality and well yields compared to the Upper Aquifer". Due to the generally shallow nature and higher salinity, very shallow groundwater is not used to provide a major supply of water for agricultural or drinking uses within the Subbasin, although some projects are being developed to reuse this water on more salt-tolerant crops. Even if the GSA doesn't define this as principal aquifer, the text indicates current or future use that could threaten ISWs and GDEs and should therefore be considered in the sustainability criteria.

Furthermore, Figures 2-43 to 2-45 show a reduction in TDS from 1990 to 2015. Thus, disregarding this shallow groundwater as a principal aquifer due to its water quality is inadequate. This is especially true in the places where projects to extract the shallow groundwater may be considered for use on more salt-tolerant crops. SGMA requires GSAs to sustainably manage groundwater resources in all aquifers, especially if groundwater use and management can result in impacts on beneficial uses and users. Please refer to Best Practice #1 in Attachment D for further explanation and accompanying graphics.

<u>Checklist Items 8 to 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)</u>

[Section 2.2.4.4.1 Natural Surface Water Features and Flow (pp. 2-42 to 2-43)]

- [TNC's comments were acknowledged and minor text changes were made; however, the changes did not adequately address our comments.] The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. ISWs can be either gaining or losing. The text states (p. 2-42) that "Based on an evaluation of Upper Aquifer groundwater levels and contours of depth to groundwater, groundwater levels underlying the intermittent streams during the 2015 baseline period demonstrates that the streams are not interconnected with the groundwater system". However, this conclusion is based on the Upper Aquifer and not the Shallow Zone of the Upper Aquifer. No evidence is provided in the GSP that states that these streams are not connected to the Upper Aquifer along some portion of the drainage for some time period. **Please provide data or analysis to back up the statement that these westside streams do not represent areas of potential GDEs or ISWs. Please reconcile data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP to improve identification of ISWs prior to disregarding them in the GSP.**

<u>Checklist Items 11 to 15 – Identifying and Mapping GDEs (23 CCR §354.16)</u>

[Section 2.2.4.4.5 Groundwater Dependent Ecosystems (p. 2-44)]

- [TNC's comments were acknowledged and minor text changes were made; however, the changes did not adequately address our comments.] The text states (p. 2-44): "The first recommended step to determine whether the TNC potential GDEs exist was to evaluate depth to water in the Upper Aquifer using 30 ft bgs as a threshold." However, this evaluation potentially misses GDEs due to the potential for GDEs to utilize the Shallow Zone of the Upper Aquifer. The following comments apply to *areas with depth to groundwater greater than 30 feet in winter 2014 to 2015:*
    - While depth to groundwater levels within 30 feet are generally accepted as being a proxy for deciding if polygons in the NC dataset are connected to groundwater, it is highly advised that seasonal and interannual groundwater

fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one point in time (e.g., Winter 2014 to 2015) can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Based on a study we recently submitted to *Frontiers in Environmental Science*, we've observed riparian forests along the Cosumnes River to experience a range in groundwater levels between 1.5 and 75 feet over seasonal and interannual timescales. Seasonal fluctuations in the regional water table can support perched groundwater near an intermittent river that seasonally runs dry due to such fluctuations. While perched groundwater itself cannot directly be managed due to its position in the vadose zone, the water table position within the regional aquifer (via pumping rate restrictions, restricted pumping at certain depths, restricted pumping around GDEs, well density rules, etc.) and its interactions with surface water (e.g., timing and duration) can be managed to prevent adverse impacts to ecosystems due to changes in groundwater quality and quantity under SGMA. **We highly recommend using depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network.**

- If there are insufficient groundwater level data in the Shallow Zone, then the NCCAGs in these areas should be included as GDEs in the GSP until data gaps are reconciled in the monitoring network. **Confirmation of GDEs should be done using depth to groundwater in the Shallow Zone. Please revise the analysis in the GSP.**
- **Please provide depth to groundwater contour maps and note the following best practices for doing so.**
  - Are the wells used for interpolating depth to groundwater sufficiently close (<5km) to NC Dataset polygons to reflect local conditions relevant to ecosystems?
  - Are the wells used for interpolating depth to groundwater screened within the surficial unconfined aquifer and capable of measuring the true water table?
  - Is depth to groundwater contoured using groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape? This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide much more accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is constant,

which is a poor assumption to make. It is better to assume that water surface elevations are constant in between wells, and then calculate depth to groundwater using a DEM of the land surface to contour depth to groundwater.

  - **Please use care when considering rooting depths of vegetation. Please list the species in each GDE, and whether the GDE was eliminated or retained based on the 30-foot depth limit.** While Valley Oak (*Quercus lobata*) have been observed to have a max rooting depth of ~24 feet (https://groundwaterresourcehub.org/gde-tools/gde-rooting-depths-database-for-gdes/), rooting depths are likely to spatially vary based on the local hydrologic conditions available to the plant. Also, max rooting depths do not take capillary action into consideration, which will vary with soil type and is an important consideration since woody phreatophytes generally do not prefer to have their roots submerged in groundwater for extended periods of time, and hence effectively redistribute their root systems to straddle the water table as it fluctuates. Hence, being highly capable of accessing groundwater at much deeper depths when needed.

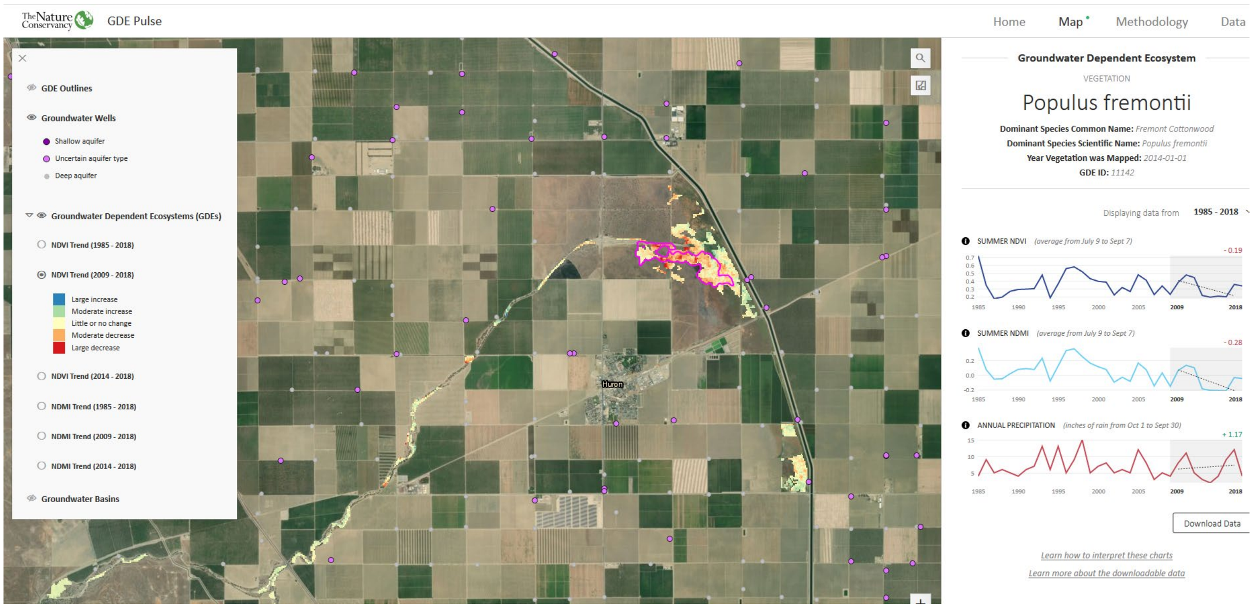
- In the scientific literature, it is generally acknowledged that GDEs can rely on groundwater for <u>some or all</u> of their requirements. GDEs can rely on multiple water sources simultaneously and at different temporal and / or spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow). SGMA defines GDEs as "ecological communities and species that depend on groundwater <u>emerging from aquifers</u> or on groundwater <u>occurring near</u> the ground surface". **Hence, we recommend using depth to groundwater contour maps derived from subtracting groundwater levels from a DEM, as described above, to identify whether a connection to groundwater exists for the wetlands mapped in Figure 2-14 in the Subbasin. Please refer to Attachments D and E of this letter for best practices for using local groundwater data to 1) verify whether polygons in the NC Dataset are supported by groundwater in an aquifer, and 2) verify ecosystem decline or recovery is correlated with groundwater levels.**
- The GSP states, "…GDEs are sparse and cover small areas, primarily occurring along ephemeral streams in the western portion of the Subbasin", and later goes on to say "…the Subbsain does not likely contain GDEs or interconnected surface water". **Please provide further information on the analysis of GDEs and westside streams, including citing field studies or modeling studies that show the hydrologic nature of these streams. Specifically indicate which streams GDE polygons were excluded from, identify any data gaps, and ensure that GDE polygons are retained <u>until</u> data gaps are reconciled.**

<u>Checklist Items 16 to 20, Describing GDEs (23 CCR §354.16)</u>

[Section 2.2.4.4.5 Groundwater Dependent Ecosystems (p. 2-44)]

- [TNC's comments were acknowledged and minor text changes were made; however, the changes did not adequately address our comments.] **Please provide**

information on the historical or current groundwater conditions near the GDEs or the ecological conditions present. Refer to GDE Pulse (https://gde.codefornature.org; See Attachment E of this letter for more details) or any other locally available data (e.g., leaf area index, evapotranspiration or other data) to describe depth to groundwater trends in and around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in the Westlands Water District.



- *[Our comment was not addressed. No changes to GSP text made.]* **Please provide an ecological inventory (see Appendix III, Worksheet 2 of the GDE Guidance) for all potential GDEs that includes vegetation or habitat types and rank the GDEs as having a high, moderate or low value. Explain how each rank was characterized.**
- *[Our comment was not addressed. No changes to GSP text made.]* **Please identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat were found in or near any of the GDEs since some organisms rely on uplands and wetlands during different stages of their lifecycle**. Resources for this include the list of freshwater species located in the Subbasin that can be found in Attachment C of this letter, the Critical Species Lookbook, and CDFW's CNDDB database.

Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)

[Section 2.3.4 Water Budget Estimation (pp. 2-46 to 2-55)]

- *[Our comment was not addressed. No changes to GSP text made.]* Evapotranspiration is included as an outflow category in the land surface budget; however, it is not split between type of evapotranspiration. **Please separate this**

term by land-use type (for example: agricultural, municipal and domestic, and native and riparian).

- *[Our comment was not addressed. No changes to GSP text made.]* Depending on the results of an updated review of GDEs, groundwater outflow to ET should be identified as a groundwater budget component. **Since potential GDEs (including wetlands, riparian vegetation, phreatophytes and other communities) are beneficial users of groundwater in the Westlands GSP area, it is appropriate to include them in these calculations.**

<u>Checklist Item 23-26 Sustainability Goal (23 CCR §354.24</u>)

[Section 3.1 Sustainability Goal (p. 3-4)]

- *[Our comment was not addressed. No changes to GSP text made.]* The Sustainability Goal states that "The goal of this GSP is to develop projects and management actions that result in the sustainable management of the groundwater resources of the Subbasin for long-term community, financial, and environmental benefits of residents and business in the Subbasin." The overall theme is to protect groundwater resources for developed water users. **Please consider modifying the theme to expand on the environmental uses and users of groundwater.**
- *[Our comment was not addressed. No changes to GSP text made.]* The Goal Description states that environmental benefits were considered when establishing the minimum threshold for groundwater level; however, the criteria used was not included in the narrative. **Please update this section to provide detail on the environmental benefits to the GSP.**
- *[Our comment was not addressed. No changes to GSP text made.]* **Since GDEs and ISWs may be present in the Subbasin (please see comments under Checklist Items 16-20) they should be recognized as beneficial users of groundwater and should be included in the Sustainability Goal. In addition, a statement about any intention to address pre-SGMA impacts should be included.**
- *[Our comment was not addressed. No changes to GSP text made.]* The GSP states that there is no ISW connectivity along the westside creeks; however, there isn't any quantitative data provided, and / or information to support this finding. **Please include ISWs in the Sustainability Goal until sufficient data is available to conclude the status of ISWs.**
- *[Our comment was not addressed. No changes to GSP text made.]* GDEs are dependent, in part, on suitable water quality; however, the GSP only considers water quality for irrigation and domestic use. **Given that there are potential GDEs in the Subbasin, and they may be affected by water quality they should be included in the Sustainability Goal and addressed in the Water Quality section.**

<u>Checklist Item 26 – Measurable Objectives (23 CCR §354.30</u>)

[Section 3.2.1 Measurable Objectives for Chronic Lowering of Water Levels (pp. 3-5 to 3-9)]

- *[Our comment was not addressed. No changes to GSP text made.]* This Measurable Objective does not consider GDEs. **Please include GDEs (see comments under**

checklist items 16-20) in this section and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.

[Section 3.2.4 Measurable Objectives for Water Quality (p. 3-14)]

- *[Our comment was not addressed. No changes to GSP text made.]* This Measurable Objective does not consider the water quality needs of GDEs. **Please modify this section to specifically address impacts from degraded water quality by TDS, Arsenic and Boron to the plant and wildlife communities within GDEs**.

[Section 3.2.5 Measurable Objectives for ISWs Systems (3-17)]

- [TNC's comments were acknowledged and minor text changes were made; however, the changes did not adequately address our comments.] This GSP states that there are no ISWs along the westside streams; however, this conclusion was based on well level that is not reasonably close to the drainages. In addition, there is no supporting data and information that demonstrates the groundwater in the drainages is not supporting ISWs. **Please modify this section of the GSP to include a statement that includes the potential for ISWs, pending the characterization of the Shallow Zone and analysis of monitoring data or monitoring from additional wells to be installed in the future.**

[Section 3.2.1.4 Impact of Selected Measurable Objectives on Adjacent Basins (p. 3-10)]

- *[Our comment was not addressed. No changes to GSP text made.]* The GSP states that "Groundwater model results indicate that the average groundwater levels reflected in the MO will result in greatly reduced net subsurface inflow to the Plan area from surrounding subbasins compared to historic net subsurface inflow. Therefore, the projects and management actions implemented for this GSP are expected to benefit adjacent subbasins and not hinder the ability of adjacent subbasins to be sustainable". **Please explain how the measurable objectives will benefit adjacent subbasins and not hinder the ability of adjacent subbasins to be sustainable. What are the mechanisms for this benefit?**

[Section 3.2.4.1 Description of Measurable Objectives (for Water Quality) (p. 3-14)]

- *[Our comment was not addressed. No changes to GSP text made.]* There is only one TDS well shown in Figure 3-5 for monitoring the Upper Aquifer, and it is located at the very southernmost tip of the GSP area. **Please explain how this one well will provide a representative estimation of TDS monitoring over the entire area and if there are data gaps, then please recognize any data gaps and state how they will be managed. If other monitoring wells will be used to manage TDS, then please state that.**

[Section 3.2.5.1 Description of Measurable Objectives and Section 3.3 Minimum Thresholds (for Interconnected Surface Waters) (pp. 3-17 to 3-18)]

- [TNC's comments were acknowledged and minor text changes were made; however, the changes did not adequately address our comments.] Sweeping statements, such as "interconnected surface water does not exist in the Subbasin and therefore no minimum objectives were developed for this sustainability indicator. If in the future data from a groundwater level monitoring indicate that surface water from the ephemeral streams in the Subbasin and groundwater are interconnected, minimum thresholds and measurable objectives will be developed" are dismissive of ISWs and should be identified as data gaps. Many of the wells are screened deeper and nested wells have not been installed to inform how shallow groundwater interacts with potential ISWs. **Please include all potential ISWs in the analysis and develop measurable objectives and minimum thresholds for these, to be managed until data gaps prove they are not interconnected.**

Checklist Item 27-29 – Minimum Thresholds (23 CCR §354.28)

[Sections 3.3.1 Minimum Thresholds for Chronic Lowering of Groundwater Levels (p. 3-19)]

- *[Our comment was not addressed. No changes to GSP text made.]* The plan states that "Chronic lowering of groundwater levels in the Subbasin cause significant and unreasonable declines if they are sufficient in magnitude to lower the rate of production of pre-existing groundwater wells below that necessary to meet the minimum required to support beneficial use(s) where alternative means of obtaining sufficient water resources are not technically or financially feasible". The minimum threshold does not include environmental beneficial users, such as ISWs or GDEs. **Although there are many data gaps associated with ISWs and GDEs, please address how potential ISWs and GDEs would be affected by further lowering of groundwater levels, and how these beneficial users will be protects / managed.**

[Section 3.3.1.5 Effects of the Beneficial Uses and Users of Groundwater (p. 3-22)]

- *[Our comment was not addressed. No changes to GSP text made.]* Effects to beneficial uses and users is focused on well capacity, pumping costs, extraction, and impacts from subsidence on infrastructure. There is no mention about potential impacts to GDEs or ISWs that could be affected by lowering of the Shallow Zone as affected by the Upper Aquifer since a continuity / discontinuity between the two is a data gap. **Please include the potential effects on ISWs and GDEs as beneficial users in this section.**

[Section 3.3.5 Minimum Thresholds for Water Quality (p. 3-27)]

- *[Our comment was not addressed. No changes to GSP text made.]* Although agricultural water quality concerns were articulated, similar concerns were not identified for environmental users. Degradation of water quality can impact terrestrial and aquatic wildlife that live in or near these ecosystems during at least part of the year even if the water is not yet a concern from an agricultural standpoint. **Please include a discussion about GDEs and water quality and whether the minimum thresholds and interim milestones will help achieve sustainability for environmental users.**

[Sections 3.3.5.5 Effects of the Beneficial Uses and Users of Groundwater (p. 3-31)]

- *[Our comment was not addressed. No changes to GSP text made.]* This section acknowledges the effects of the beneficial uses of groundwater as it relates to agriculture, urban and domestic uses. **Please add an additional statement to acknowledge how environmental uses and users would be affected by degradation of groundwater quality.**

[Sections 3.3.6 Minimum Thresholds for Interconnected Groundwater Surface Waters (p. 3-31)]

- [TNC's comments were acknowledged and minor text changes were made; however, the changes did not adequately address our comments.] The GSP states that ISWs do not exist within the Westside Subbasin. **Please modify this section of the GSP to 1) identify possible ISWs, and 2) include a statement that there is a data gap related to the interconnectedness of the Shallow Zone with respect to possible ISWs.**

Checklist Item 30-36 – Undesirable Results (23 CCR §354.26)

[Section 3.4.1.1 Undesirable Results (for chronic lowering of groundwater levels) (p. 3-36 to 3-37)]

- *[Our comment was not addressed. No changes to GSP text made.]* This section only describes undesirable results relating to human beneficial uses of groundwater and neglects environmental beneficial uses / users that could be adversely affected by chronic groundwater level decline. **Please add "possible adverse impacts to potential GDEs and ISWs" to the list of potential undesirable results.**
- *[Our comment was not addressed. No changes to GSP text made.]* The GDE Pulse web application developed by TNC provides easy access to 35 years of satellite data to view trends of vegetation metrics, groundwater depth (where available), and precipitation data. This satellite imagery can be used to observe trends for NC dataset polygons within and near the GSA. Over the past 10 years (2009-2018), some NC dataset vegetation polygons have experienced adverse impacts to vegetation growth and moisture. An example screen shot of GDEs near Huron, California from the GDE Pulse tool is presented under Checklist items 11-15 above.
    - **For each identifiable GDE unit with supporting hydrological datasets please include the following:**
        - Plot and provide hydrological datasets for each GDE.
        - Define the baseline period in the hydrologic data.
        - Classify GDE units as having high, moderate, or low susceptibility to changes in groundwater.
        - Explore cause-and-effect relationships between groundwater changes and GDEs.

- **For each identifiable GDE unit without supporting hydrological datasets please describe data gaps and / or insufficiencies.**
- **Compile and synthesize biological data for each GDE unit by:**
  - Characterizing biological resources for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.
  - Describing data gaps / insufficiencies.
- **Describe possible effects on potential ISWs, GDEs, land uses, and property interests, including:**
  - Cause-and-effect relationships between potential ISWs and GDEs with groundwater conditions.
  - Impacts to potential ISWs and GDEs that are considered to be "significant and unreasonable".
  - Report known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities.
  - Land uses should include recreational uses (e.g., fishing/hunting, hiking, boating).
  - Property interests should include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.

[Section 3.4.1.4 Undesirable Results (for degraded groundwater quality) (p. 3-37)]

- *[Our comment was not addressed. No changes to GSP text made.]* Section 2.2.2.2 Water Quality (p. 2-36) discusses water quality with respect to agricultural and municipal use but does not include metrics for GDEs and ISWs. **Please modify this section to specifically address degraded water quality from TDS and B to the vegetative portion of GDEs and ISWs. Although Se and As are mentioned in this section please consider adding a statement that over-pumping and dewatering of aquitards has been identified as a potential source of elevated As concentrations above drinking water standards in San Joaquin Valley aquifers.** The following is a link to a paper by Smith, Knight and Fendorf (2018) titled "Overpumping leads to California groundwater arsenic threat": https://www.nature.com/articles/s41467-018-04475-3

[Sections 3.4.1.5 Undesirable Results (for depletion of interconnected surface water) (p 3-38)]

- *[Our comment was not addressed. No changes to GSP text made.]* The GSP states that there are no ISWs; however, there are no monitoring data and information to support this statement. A data gap needs to be identified and a monitoring network employed to verify the status of ISWs prior to complete dismissal of ISWs from the GSP. **Please modify this section of the GSP to include a statement that 1) there are potential ISWs, 2) there will be no increase in depletions of potential ISWs, 3) and the presence or absence of ISWs will be verified with monitoring wells screened at the appropriate depth.**

Checklist Item 37-46 – Undesirable Results (23 CCR §354.26)

- *[Our comment was not addressed. No changes to GSP text made.]* Biological data should be compiled and synthesized for each GDE unit. **Based on the potential for GDEs in the Subbasin please include:**
  - Characterization of biological resources for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.
  - A description of data gaps / insufficiencies.
  - Stated plans to reconcile data gaps in the monitoring network.
- *[Our comment was not addressed. No changes to GSP text made.]* **Describe the following potential effects on GDEs, land uses and property interests:**
  - Cause-and-effect relationships between GDE and groundwater conditions.
  - Impacts to GDEs that are considered to be "significant and unreasonable".
  - Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities.
  - Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).
  - Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.

Checklist Items 47-49 – Monitoring Network (23 CCR §354.34)

[Section 3.3.1.1 Description of Minimum Threshold (p. 3-19)]

- *[Our comment was not addressed. No changes to GSP text made.]* The GSP proposes to use groundwater level monitoring for tracking groundwater level and as a proxy for groundwater storage. A set of representative wells has been selected to monitor the Upper Aquifer and the Lower Aquifer, shown in Figure 3-1. In addition, the Plan proposes five new wells to fill in water level and water quality data gaps. Although under Section 3.8.9.7 (Description of Steps to Remedy Data Gaps (p. 3-70)), there is acknowledgement of assessing GDEs in the future however there is no discussion of ISWs. This section of the GSP also states that the GSA will look at the data gaps brought forth in the GDE assessment but there is minimal articulation of a GDE assessment in the GSP. In addition, the wells identified in Figure 3-7 and described in the text do not provide any assurance that the wells can support clarification of the ISW and GDE data gaps. **Please modify the description of the new well network to provide methodologies, data and other information to support the investigation of GDEs and ISWs. This modification should include 1) locating new wells that are appropriately screened to detect connectivity of GDEs and ISWs with the Shallow Zone and Upper Aquifer, 2) identifying or installing additional stream gages in areas where there is potential for ISWs and GDEs, and 3) support for improving information on the Shallow Zone of the Upper Aquifer. Please expand on the discussion of how the new well and stream data will be used to improve ISW mapping and inform an adequate analysis, and how the data will be used to verify possible GDEs.**

- *[Our comment was not addressed. No changes to GSP text made.]* As stated above in the comments for Checklist Items 8-10, **please reconcile data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells) along westside ephemeral streams in this section of the GSP to improve ISW mapping in future GSPs**.

Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)

[Chapter 4 Projects and Management Actions to Achieve Sustainability Goal (pp. 4-1 to 4-26)]

- *[Our comment was not addressed. No changes to GSP text made.]* This chapter identifies many important projects; however, the descriptions of Measurable Objectives for these projects only identifies benefits to water level and storage through changes in allocation, imports, and pumping allowances; initiating injection programs; and adding percolation basin. Since maintenance or recovery of groundwater levels, or construction of recharge facilities, may have potential environmental benefits in many cases it would be advantageous to demonstrate multiple benefits from a funding and prioritization perspective.
    - **For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.**
    - If ISWs will not be adequately protected by those listed, **please include and describe additional management actions and projects targeted for protecting ISWs.**
    - Recharge / percolation ponds, such as those identified in Section 4.5 Project No. 5 – Percolation Basins (p. 4-23), and similar facilities can be designed to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. In some cases, such facilities have been incorporated into local HCPs and NCCPs, more fully recognizing the value of the habitat that they provide and the species they support. For projects that construct recharge ponds, **please consider identifying if there is habitat value incorporated into the design and how the recharge ponds will be managed to benefit environmental users.**
    - For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

[Section 4.2.1.1 Groundwater Allocation (p. 4-10) and Section 4.2.1.2 Aquifer-Specific Groundwater Allocation (p. 4-12)]

- *[Our comment was not addressed. No changes to GSP text made.]* For Project No. 2 (Initial Allocation of Groundwater Extraction) and regarding groundwater allocation, the GSP states "Recognizing the current underutilization of the Upper Aquifer, the GSA has elected to allow landowners to apply for a gross groundwater allocation or aquifer-specific groundwater allocation…". In general, the GSP has not characterized continuity or discontinuity between the Shallow Zone and the Upper Aquifer, but rather focused on the Lower Aquifer. Since ISWs and GDEs would be connected to the Shallow Zone [and Upper Aquifer where the Shallow Zone is connected], then the Shallow Zone and any potential GDEs and ISWs must be properly characterized prior to implementation of projects that increase utilization of the Upper Aquifer and Shallow Zone. This GSP does not present data or information to support that there would be no impact on the Shallow Zone through pumping in the Upper Aquifer. **Please provide data to show the dynamics between the Shallow Zone and Upper Aquifer. Also provide 1) a description of how GDEs will be affected by this project and other projects and management actions listed in Chapter 4; 2) how projects and management actions will be evaluated to assess whether adverse impacts to potential GDEs and ISWs will be mitigated or prevented; 3) establish the connection between GDES, ISWs, the Shallow Zone and the Upper Aquifer; and 4) how this project and others will benefit environmental users.**

[Section 5.1 Monitoring Costs (p. 5-1)]

- *[Our comment was not addressed. No changes to GSP text made.]* The Subbasin potentially includes GDEs and ISWs (see our comments under Checklist Items 8-10 and 16-20 above) that are beneficial uses and users of groundwater and may include sensitive and protected resources. Environmental resource protection needs should be considered in establishing project priorities. In addition, and consistent with existing grant and funding guidelines for SGMA-related work, priority should be given to multi-benefit projects that can address water quantity and quality as well as providing environmental benefits or benefits to disadvantaged communities.

Attachment C

Freshwater Species Located in the Westside Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Westside Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[3]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[4] as well as on TNC's science website[5].

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		SSC	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			

[3] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[4] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[5] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Geothlypis trichas trichas	Common Yellowthroat			
Himantopus mexicanus	Black-necked Stilt			
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Phalacrocorax auritus	Double-crested Cormorant			
Pipilo aberti	Abert's Towhee			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Rynchops niger	Black Skimmer			
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Laterallus jamaicensis coturniculus	California Black Rail	BCC	Threatened	BLM
Empidonax traillii	Willow Flycatcher	BCC	Endangered	USFS
Haliaeetus leucocephalus	Bald Eagle	BCC	Endangered	USFS, BLM
Pelecanus erythrorhynchos	American White Pelican		SSC	BSSC - First priority
Piranga rubra	Summer Tanager		SSC	BSSC - First priority
Agelaius tricolor	Tricolored Blackbird	BCC	SSC	BSSC - First priority, BLM
Histrionicus histrionicus	Harlequin Duck		SSC	BSSC - Second priority
Ixobrychus exilis hesperis	Western Least Bittern		SSC	BSSC - Second priority
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Cypseloides niger	Black Swift	BCC	SSC	BSSC - Third priority
Geothlypis trichas sinuosa	Saltmarsh Common Yellowthroat	BCC	SSC	BSSC - Third priority
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		SSC	BSSC - Third priority
CRUSTACEANS				
Caecidotea tomalensis	Tomales Isopod		SSC	
Hyalella spp.	Hyalella spp.			
FISHES				
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	SSC	Endangered - Moyle 2013

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Hypomesus pacificus	Delta smelt	Threatened	Endangered	Endangered - Moyle 2013
Oncorhynchus gorbuscha	Pink salmon		SSC	Endangered - Moyle 2013
Oncorhynchus keta	Chum salmon		SSC	Endangered - Moyle 2013
Oncorhynchus tshawytscha - CV late fall	Central Valley late fall Chinook salmon	SSC		Endangered - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	SSC	Endangered - Moyle 2013
Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Cottus aleuticus	Coastrange sculpin			Least Concern - Moyle 2013
Cottus asper ssp. 1	Prickly sculpin			Least Concern - Moyle 2013
Gasterosteus aculeatus aculeatus	Coastal threespine stickleback			Least Concern - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
Hysterocarpus traskii traskii	Sacramento tule perch		SSC	Near-Threatened - Moyle 2013
Lampetra ayersi	River lamprey		SSC	Near-Threatened - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		SSC	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		SSC	Near-Threatened - Moyle 2013
Entosphenus tridentata ssp. 1	Pacific lamprey		SSC	Near-Threatened - Moyle 2013, BLM, USFS
Lampetra richardsoni	Western brook lamprey			Near-Threatened - Moyle 2013, USFS
Mylopharodon conocephalus	Hardhead		SSC	Near-Threatened - Moyle 2013, USFS
Acipenser transmontanus	White sturgeon		SSC	Vulnerable - Moyle 2013
Eucyclogobius newberryi	Tidewater goby	Endangered	SSC	Vulnerable - Moyle 2013

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Oncorhynchus mykiss - CCC winter	Central California coast winter steelhead	Threatened	SSC	Vulnerable - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	SSC	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV fall	Central Valley fall Chinook salmon	SSC	SSC	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endangered	Endangered	Vulnerable - Moyle 2013
Pogonichthys macrolepidotus	Sacramento splittail		SSC	Vulnerable - Moyle 2013
Spirinchus thaleichthys	Longfin smelt	Candidate	Threatened	Vulnerable - Moyle 2013
Eucyclogobius newberryi	Tidewater goby	Endangered	SSC	Vulnerable - Moyle 2013
Spirinchus thaleichthys	Longfin smelt	Candidate	Threatened	Vulnerable - Moyle 2013
Anaxyrus boreas boreas	Boreal Toad			
Pseudacris regilla	Northern Pacific Chorus Frog			
Thamnophis sirtalis sirtalis	Common Gartersnake			
Thamnophis sirtalis tetrataenia	San Francisco Gartersnake	Endangered	Endangered	
Rana draytonii	California Red-legged Frog	Threatened	SSC	ARSSC
Taricha torosa	Coast Range Newt		SSC	ARSSC
Actinemys marmorata marmorata	Western Pond Turtle		SSC	ARSSC, BLM, USFS
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	SSC	ARSSC, BLM, USFS
Thamnophis atratus atratus	Santa Cruz Gartersnake			Not on any status lists
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis elegans terrestris	Coast Gartersnake			Not on any status lists
INSECTS AND OTHER INVERTEBRATES				

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Alotanypus spp.	Alotanypus spp.			
Apedilum spp.	Apedilum spp.			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetis tricaudatus	A Mayfly			
Brillia spp.	Brillia spp.			
Chironomus spp.	Chironomus spp.			
Conchapelopia spp.	Conchapelopia spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Ephydridae fam.	Ephydridae fam.			
Heterotrissocladius spp.	Heterotrissocladius spp.			
Ischnura cervula	Pacific Forktail			
Lestes stultus	Black Spreadwing			
Libellula pulchella	Twelve-spotted Skimmer			
Libellulidae fam.	Libellulidae fam.			
Metriocnemus spp.	Metriocnemus spp.			
Micropsectra spp.	Micropsectra spp.			
Pachydiplax longipennis	Blue Dasher			
Parametriocnemus spp.	Parametriocnemus spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Plathemis lydia	Common Whitetail			
Polypedilum spp.	Polypedilum spp.			
Psectrotanypus spp.	Psectrotanypus spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Rhionaeschna californica	California Darner			
Simulium spp.	Simulium spp.			
Tanytarsus spp.	Tanytarsus spp.			
Zavrelimyia spp.	Zavrelimyia spp.			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Ischnura gemina	San Francisco Forktail		SSC	IUCN - Vulnerable
Tropisternus californicus				Not on any status lists
MAMMALS				
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Gonidea angulata	Western Ridged Mussel		SSC	
Hydrobiidae fam.	Hydrobiidae fam.			
Margaritifera falcata	Western Pearlshell		SSC	
Menetus spp.	Menetus spp.			
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Anodonta californiensis	California Floater		SSC	USFS
PLANTS				
Alopecurus pratensis	NA			
Arundo donax	NA			
Carex obnupta	Slough Sedge			
Ceratophyllum demersum	Common Hornwort			
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Euthamia occidentalis	Western Fragrant Goldenrod			
Galium trifidum	Small Bedstraw			
Isolepis cernua	Low Bulrush			
Juncus effusus effusus	NA			
Juncus falcatus falcatus	Sickle-leaf Rush			
Juncus phaeocephalus phaeocephalus	Brown-head Rush			
Lemna minuta	Least Duckweed			
Mimulus guttatus	Common Large Monkeyflower			
Myriophyllum aquaticum	NA			
Phacelia distans	NA			

Scientific Name	Common Name	Legally Protected Species		
		Federal	State	Other
Psilocarphus tenellus	NA			
Ranunculus repens	NA			
Ruppia cirrhosa	Widgeon-grass			
Salix exigua exigua	Narrowleaf Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Schoenoplectus californicus	California Bulrush			
Schoenoplectus pungens pungens	NA			
Sequoia sempervirens				
Sisyrinchium californicum	Golden Blue-eyed-grass			
Stachys albens	White-stem Hedge-nettle			
Symphyotrichum lanceolatum lanceolatum	NA			
Plagiobothrys chorisianus	NA		SSC	CRPR - 1B.2
Equisetum palustre	NA		SSC	CRPR - 3
Stellaria littoralis	Beach Starwort		SSC	CRPR - 4.2
Azolla microphylla	Mexican mosquito fern		SSC	CRPR - 4.3
Juncus lescurii				Not on any status lists
Ludwigia peploides montevidensis	NA			Not on any status lists
Ludwigia peploides peploides	NA			Not on any status lists
Persicaria amphibia				Not on any status lists
Persicaria punctata	NA			Not on any status lists
Potentilla anserina anserina				Not on any status lists
Rumex occidentalis				Not on any status lists

Notes:
ARSSC = At-Risk Species of Special Concern
BCC = Bird of Conservation Concern
BSSC = Bird Species of Special Concern
CRPR = California Rare Plant Rank
CS = Currently Stable
IUCN = International Union for Conservation of Nature
SSC = Species of Special Concern

Attachment D

July 2019

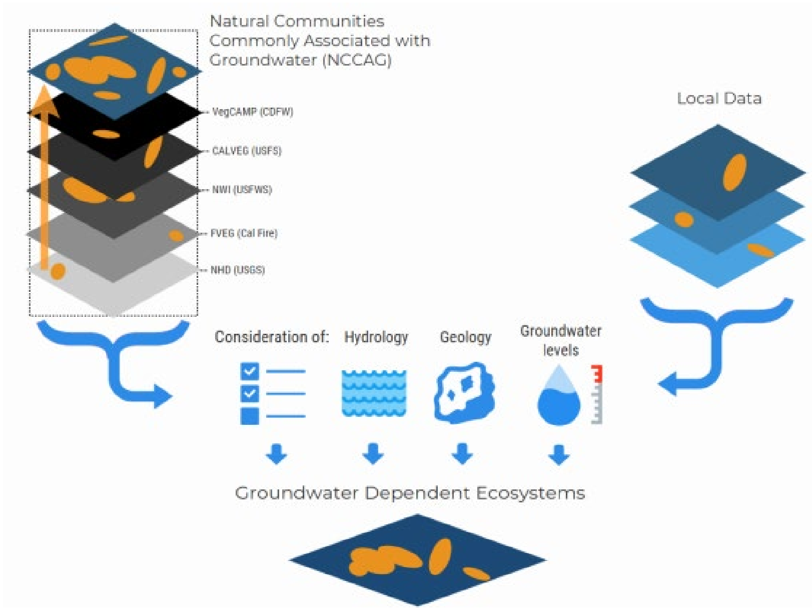
IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[6] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[7]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

[6] *NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/*

[7] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf



The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[8]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[9] on the Groundwater Resource Hub[10], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may

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[8] *For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf*
[9] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[10] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

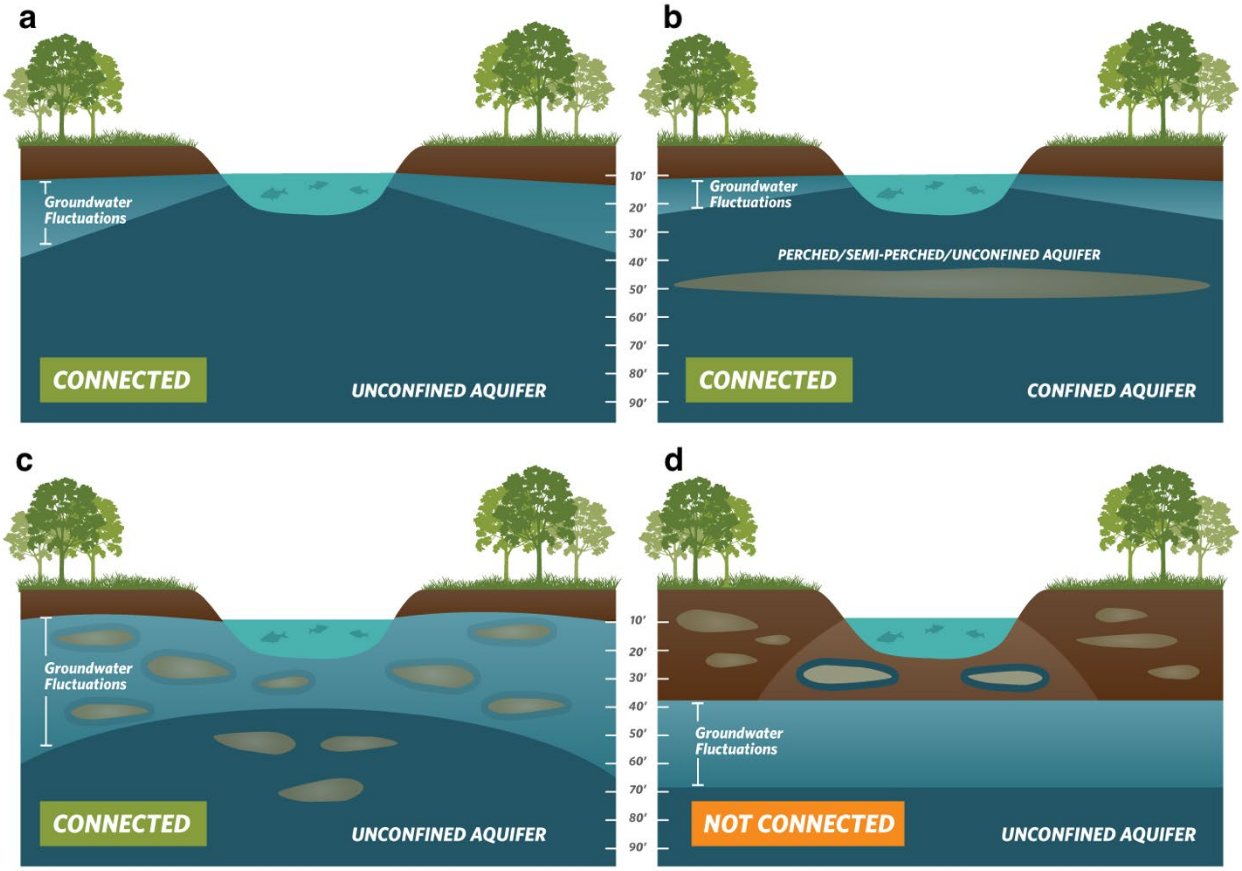

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[11] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[12] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[13] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[14]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

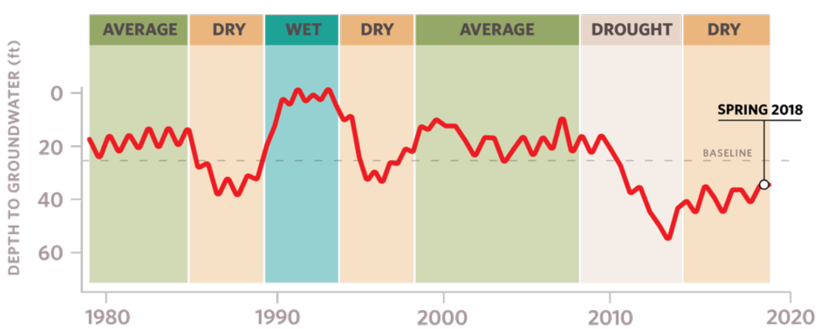

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[11] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[12] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[13] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[14] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[15], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

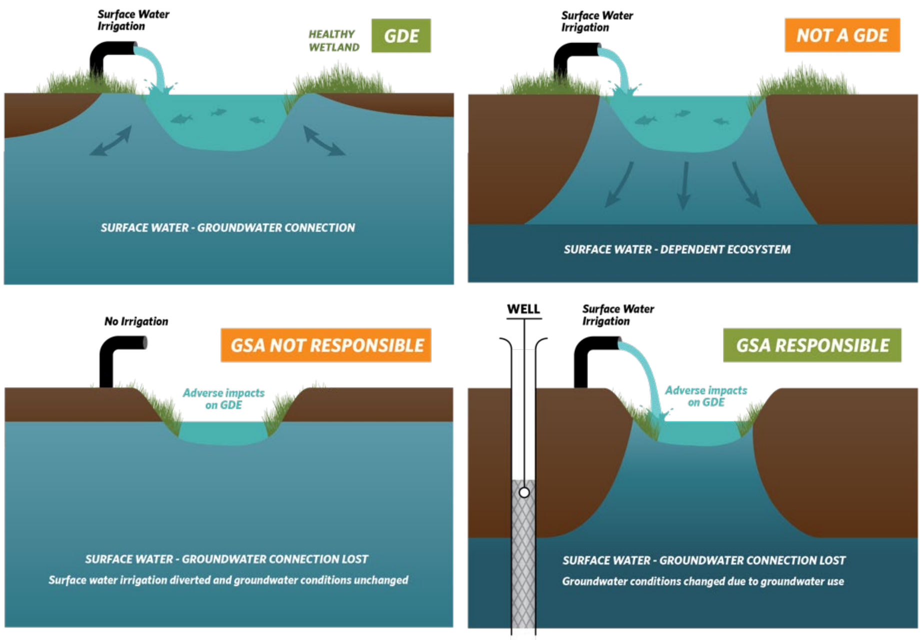

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[15] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

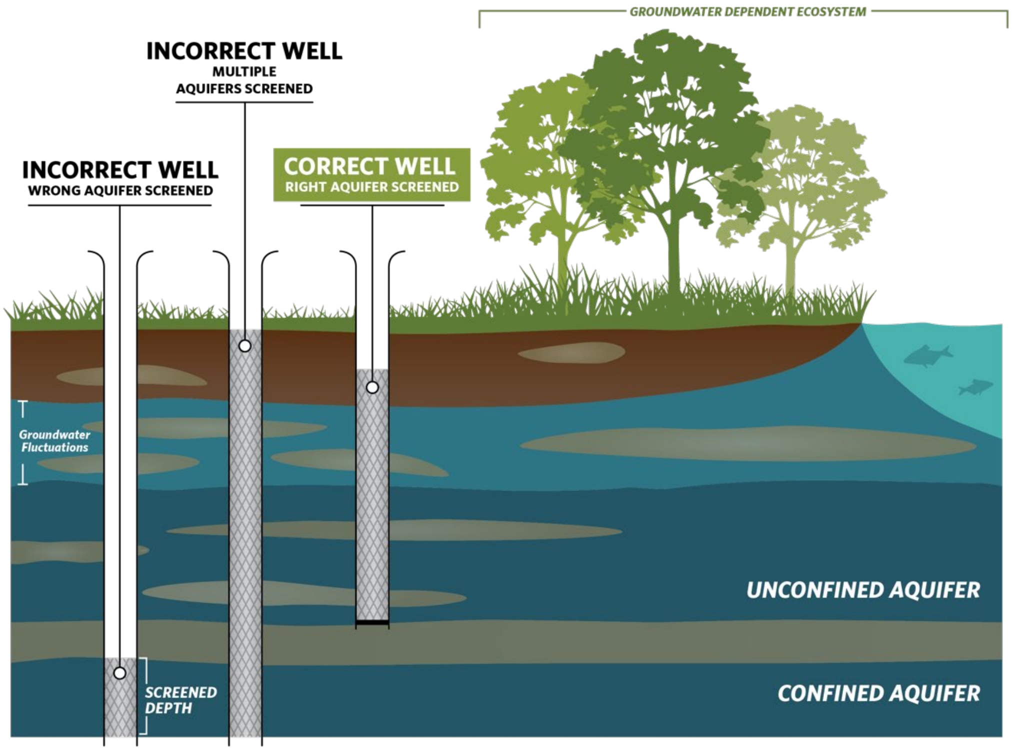

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[16] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

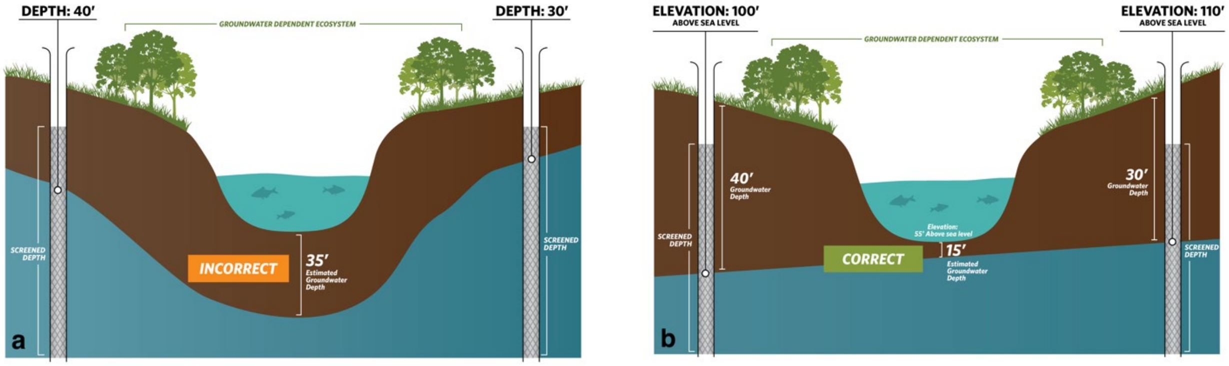

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

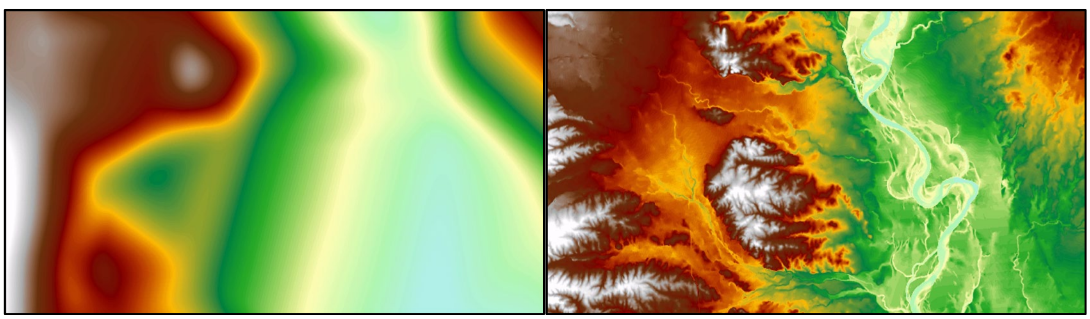

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[16] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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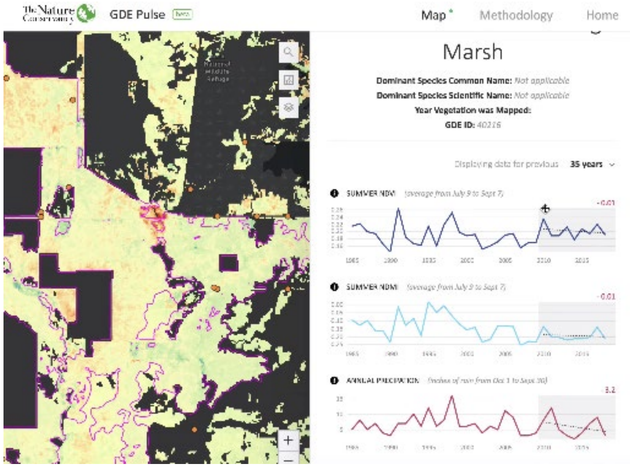

Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[17]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[18]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

[17] The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#

[18] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

TNC as a Representative for Environmental Beneficial Users

The state of California contains more species of plants and animals than the rest of the United States and Canada combined[19]. For over 200 years, California's natural ecosystems have been converted to agricultural and urban landscapes. This modification of land and water has resulted in approximately 95% reduction in the historical extent of California's aquatic and wetland habitats[20]. Subsequently, more than 90% of all native freshwater species endemic to California are vulnerable to extinction[21] within the next 100 years. To prevent this, water managers at every scale have a responsibility to manage groundwater sustainably, meeting the needs of people and the environment. TNC is working to help by providing the science, tools and solutions needed to halt the decline of our freshwater biodiversity.

Important Plan Evaluation Provisions

Per the Emergency Regulations Section 355.4(b), the Department shall evaluate plans for compliance considering ten factors, including the following, which are of particular interest to TNC:

(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science.

(2) Whether the Plan identifies reasonable measures and schedules to eliminate data gaps.

(4) Whether the interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have been considered.

(10) Whether the Agency has adequately responded to comments that raise credible technical or policy issues with the Plan.

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[19] *https://www.ncbi.nlm.nih.gov/pubmed/12753220*
[20] *Warner & Hendrix 1984; Moyle & Williams 1990; Moyle & Leidy 1992; Seavy et al. 2009*
[21] *Moyle et al. 2011; Moyle et al. 2013; Howard et al. 2015*

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June 3, 2020

California Department of Water Resources
Sustainable Groundwater Management Office

Submitted online via: https://sgma.water.ca.gov/portal/gsp/all

Re: Yuba Subbasins Water Management Plan Groundwater Sustainability Plan, North Yuba and South Yuba Groundwater Subbasins

Dear DWR Representative,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Yuba Subbasins Water Management Plan Groundwater Sustainability Plan (GSP or Plan), for the North Yuba and South Yuba Groundwater Subbasins, prepared under the Sustainable Groundwater Management Act (SGMA).

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater be considered in the development and implementation of GSPs (Water Code § 10723.2, 23 CCR §355.4(b)(4)). The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing sustainable groundwater management from the status quo.

TNC Summary of GSP Review

TNC has carefully reviewed the Plan and we appreciate the work that has gone into its preparation. Based on our review, we found the Plan to be incomplete in addressing environmental beneficial uses and users. While the GSP addressed environmental beneficial users in some respects, our review finds that portions of the GSP should be remedied before being approved. Many of the gaps can be addressed now, and we encourage the Department to require these corrections prior to approval. In some cases, it may be difficult to address gaps within 180 days. In these cases, we strongly recommend that the Department set clear expectations that these be corrected in the 2025 plan update, and to the degree that gaps are due to lack of data, that these data gaps be addressed to inform the 2025 update.

To assist in managing groundwater for the needs of natural communities, we provide a summary of our technical review below. Our specific comments are detailed in Attachment B and are in reference to numbered items in the checklist in Attachment A. Attachment C describes six best practices to confirm a connection to groundwater for DWR's NC Dataset. Attachment D provides a map and method summary of potential ISWs.

Our Key Considerations

Interconnected Surface Waters (ISWs) – We are pleased to see that the GSP identified and mapped ISWs, including gaining and losing reaches and accounted for the spatial and temporal variations inherent with California's Mediterranean climate. The GSP also identified environmental users of surface water, which is required to assess whether surface water depletions caused by groundwater use are having an adverse impact (23 CCR §354.28(c)(6)). However, improvements should be made to further characterize the shallow portion of the principal aquifer and refine the groundwater model to improve the modeled relationship between interconnected surface water and groundwater. Please see our detailed feedback in Attachment B.

Map and Assessment of potential ISWs:
By combining multiple years and seasons of groundwater depth data, The Nature Conservancy's assessment found that within the Yuba Subbasins Water Management Plan GSP, 39.2 river miles are likely to be gaining, 187.2 are likely to be losing, and the rest are uncertain or likely disconnected. Attachment D contains a one-page method summary and a GSP-specific map of ISWs. The interconnected surface water displayed on the map is based on the minimum groundwater depth estimated by the California Department of Water Resources between 2011 and 2018, and only analyzes rivers and streams with groundwater depth data available from DWR.

Note: In most cases, the groundwater depth data used to generate the ISW map does not include perched aquifers, which may be particularly important in the Plan area. As such, some streams marked as disconnected could in actuality, be connected.

Groundwater Dependent Ecosystem (GDEs) – According to the Natural Communities Commonly Associated with Groundwater dataset (NC Dataset), 9,690 acres of potential GDEs occur in the GSA boundary. TNC developed the *Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs*[1], which represents the best available science on how GDEs should be considered in plans. The guidance includes methods for how GSAs should confirm or eliminate GDEs, starting with the NC Dataset.

While we were pleased to see that the GSP took some steps to identify and map GDEs, we found that some GDEs were improperly omitted. We recommend that the GSP remedy the omissions by following our recommendations in Attachment B. The GSP should also revisit all components of the plan where GDEs, as a beneficial user, must be considered, especially in determining undesirable results, minimum thresholds and measurable objectives. Our review found that NC Dataset polygons were improperly omitted from the GDE map as follows:

- GDEs were incorrectly removed on the basis of groundwater depths greater than 25 feet being "unlikely to support recruitment of new oak seedlings." However, there may be mature tree species with rooting depths greater than 25 feet that are likely connected to groundwater. Regardless of life stage, any plant or animal species in the NC polygons that is possibly connected to groundwater should be mapped as an actual or potential GDE.
- GDEs were incorrectly removed in areas adjacent to irrigated fields due to the presence of surface water. However, GDEs can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated

[1] *Available at:* https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

fields - simultaneously and at different temporal/spatial scales. Basins with a stacked series of aquifers may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow principal aquifers, that support springs, surface water, and groundwater dependent ecosystems. NC polygons adjacent to irrigated land can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to irrigated fields.

- GDEs were incorrectly removed in areas near or supplied with supplemental surface water (near Goldfields, surface water reservoirs and streams/ditches). The application of supplemental water to recharge areas does not preclude the possibility that NC polygons could be accessing groundwater in addition to the supplied water. This approach is inconsistent with the best available science because GDEs can rely on multiple water sources simultaneously and at different temporal or spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow).
- GDEs located next to losing streams were incorrectly removed. This removal criterion does not necessarily prove that the plants and animals do not access groundwater, since near losing reaches groundwater gradients are close enough to the surface to support ecological communities such as riparian vegetation. Instead, we recommend analyzing groundwater levels, since GDEs are defined as 'ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface' [23 CCR § 350(m)].

<u>TNC recommendation</u>: TNC recommends that the GSA utilize groundwater levels that represent interannual and inter-seasonal variability along with additional information provided in Attachment C which provides best practices for using the NC dataset to identify and consider GDEs throughout the GSP. Specifically, the GSA should use a Digital Elevation Model (DEM) when developing depth to groundwater contours, as further described in Best Practice #5 in Attachment C.

Water Budget – We would like to commend the GSP for including the groundwater demands of native vegetation and managed wetlands in the historical, current and projected water budgets.

Sustainable Management Criteria – We were disappointed to see that the Sustainable Management Criteria do not describe impacts on environmental users of groundwater and/or confirm that minimum thresholds for interconnected surface waters avoid adverse impacts to environmental beneficial users of surface water, as required under SGMA (23 CCR §354.26(b)(3), 354.28(b)(4) and (c)(B)(6)). Sustainable Management Criteria for groundwater levels do not consider the effects of potential groundwater level declines on GDEs. Because the GSP argues that the shallow aquifer is not a principal aquifer, Sustainable Management Criteria for ISWs use groundwater elevations from the *deep* aquifer by proxy, despite an acknowledged interconnection between shallow groundwater and surface water. This is problematic because without identifying potential impacts to GDEs and adverse impacts to beneficial users of surface waters, minimum thresholds may be set incorrectly.

TNC recommendation: As required by SGMA, the undesirable results should include a description of potential effects on environmental beneficial uses and users of groundwater (i.e., GDEs and instream habitats within ISWs). In addition, the GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters. Both of these recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law. Where the GSP identifies important environmental beneficial users of groundwater or surface water, TNC recommends that SMCs be developed to protect habitat and species. For the Yuba Subbasins, protected species includes Central Valley steelhead and fall-run Chinook salmon.

Monitoring Network – We would like to commend the GSP for developing a monitoring network that adequately characterizes the interaction of GDEs and other environmental beneficial users of surface water and groundwater. Specifically, TNC applauds the proposed use of TNC's GDE Pulse Tool for continued GDE and depletion evaluation.

In closing, SGMA is based on two important ideas. First, California's goal is not just groundwater management, but sustainable groundwater management that considers and balances the needs of all beneficial users. This goal can only be achieved when input from environmental beneficial users is reflected in the plan. Second, SGMA is a long-term commitment to continually improve sustainable groundwater management. The Department has a critical role in maintaining a high bar for plan approval and setting the expectation that each plan, and the resulting groundwater conditions, improve over time.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	**2.1.5 Notice & Communication** *23 CCR §354.10*	**Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.**	1
Planning Framework	**2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8*	**Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.**	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	**2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14*	**Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	**Interconnected surface waters:**	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

<table>
<tr><td rowspan="11"></td><td rowspan="9"></td><td rowspan="3">If NC Dataset was used:</td><td>Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).</td><td>12</td></tr>
<tr><td>The basin’s GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).</td><td>13</td></tr>
<tr><td>GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.</td><td>14</td></tr>
<tr><td>If NC Dataset was not used:</td><td>Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.</td><td>15</td></tr>
<tr><td colspan="2">Description of GDEs included:</td><td>16</td></tr>
<tr><td colspan="2">Historical and current groundwater conditions and variability are described in each GDE unit.</td><td>17</td></tr>
<tr><td colspan="2">Historical and current ecological conditions and variability are described in each GDE unit.</td><td>18</td></tr>
<tr><td colspan="2">Each GDE unit has been characterized as having high, moderate, or low ecological value.</td><td>19</td></tr>
<tr><td colspan="2">Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).</td><td>20</td></tr>
<tr><td rowspan="2">2.2.3
Water Budget
23 CCR §354.18</td><td colspan="2">Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin’s historical and current water budget.</td><td>21</td></tr>
<tr><td colspan="2">Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.</td><td>22</td></tr>
<tr><td rowspan="10">Sustainable Management Criteria</td><td rowspan="3">3.1
Sustainability Goal
23 CCR §354.24</td><td colspan="2">Environmental stakeholders/representatives were consulted.</td><td>23</td></tr>
<tr><td colspan="2">Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.</td><td>24</td></tr>
<tr><td colspan="2">Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.</td><td>25</td></tr>
<tr><td>3.2
Measurable Objectives
23 CCR §354.30</td><td colspan="2">Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.</td><td>26</td></tr>
<tr><td rowspan="3">3.3
Minimum Thresholds
23 CCR §354.28</td><td colspan="2">Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:</td><td>27</td></tr>
<tr><td colspan="2">Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?</td><td>28</td></tr>
<tr><td colspan="2">Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?</td><td>29</td></tr>
<tr><td rowspan="3">3.4
Undesirable Results
23 CCR §354.26</td><td colspan="2">For GDEs, hydrological data are compiled and synthesized for each GDE unit:</td><td>30</td></tr>
<tr><td rowspan="2">If hydrological data are available within/nearby the GDE</td><td>Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).</td><td>31</td></tr>
<tr><td>Baseline period in the hydrologic data is defined.</td><td>32</td></tr>
</table>

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	**3.5 Monitoring Network** *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	**4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Yuba Subbasins Groundwater Sustainability Plan

The Yuba Subbasins Groundwater Sustainability Plan (GSP) dated December 27, 2019 was reviewed by TNC. This attachment summarizes our comments on the Final GSP. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

[Section 1.2.2 Beneficial Uses and Users (p. 1-17)]

- TNC acknowledges and appreciates the recognition of the types and locations of environmental uses, species and habitats supported, and other designated beneficial environmental uses of surface waters that may be affected by groundwater management in the Yuba Subbasins as taken from the following sources, as specified in Appendix C of the GSP:
    - The NC Dataset (https://gis.water.ca.gov/app/NCDatasetViewer/) which identifies potential presence of groundwater dependent ecosystems.
    - The list of freshwater species located in the Yuba Subbasins as developed by TNC using the California Freshwater Species Database.
    - CDFW's California Natural Diversity Database (CNDDB) - https://www.wildlife.ca.gov/Data/CNDDB

Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8)

[Section 2.1.5.3.12 Permitting of New Wells (p. 2-34)]

- Well permitting is currently handled by the Yuba County Environmental Health Department. The DWR well construction/destruction standards are followed (Bulletin 74-81). **Please include a discussion of how future well permitting will be coordinated with the GSP to assure achievement of the Plan's sustainability goals.**
- The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF vs. SWRCB and Siskiyou County, No. C083239). **Compliance of well permitting programs with this requirement should be stated in the GSP.**

[Section 2.1.5.4 General Plans in Plan Area (p. 2-34)]

- In this section, please include a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals. **Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan**

policies and procedures regarding the protection of wetlands, aquatic resources and other GDEs and ISWs.

- This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin and if they are associated with critical, GDE or ISW habitats. **Please identify any relevant HCPs and NCCPs within the Subbasin and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.**
- Please refer to the Critical Species Lookbook[2] to review and discuss the potential groundwater reliance of critical species in the basin. **Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.**

Checklist Items 5, 6, and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)

[Section 2.2.1.8.2 Bottom of the Yuba Subbasins (p. 2-68)]

- Defining the bottom of subbasin based on geochemical properties is a suitable approach for defining the base of freshwater, however, as noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** This will prevent the possibility of extractors with wells deeper than the basin boundary (defined by the base of freshwater) from claiming exemption of SGMA due to their well residing outside the vertical extent of the basin boundary.

[Section 2.2.1.9 Principal Aquifers and Aquitards (p. 2-70)]

- This section notes that there is one principal aquifer in the Yuba Subbasins. This paragraph attempts to exclude the shallow system as not being a principal aquifer ("aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems") as defined by SGMA [23 CCR §351(aa)]. However, it is noted that there are vertical gradients between the shallow subsurface and the deeper portions of the one principal aquifer. Thus, the shallow system is connected and could be considered as part of the same principal aquifer. Downward vertical gradients indicate there is potential for pumping in the deeper aquifer pumping to cause depletions in the connected upper shallow system, and thus, there is a potential impact to any potentially connected surface water bodies or environmental users of water. **TNC disagrees with the statement that the shallow system is not a principal aquifer. The shallow system itself may not be considered a separate principal aquifer, but as part of the entirety of the principal aquifer.**

Checklist Items 8, 9, and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)

[2] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

[Section 2.2.2.6.1 Ephemeral and Intermittent Streams (p. 2-139)]

- Figure 2-86 lists some additional minor perennial streams that are named. There is the potential that these sloughs and creeks are potentially dependent on groundwater, as well as the noted tailwater and "subsurface flow from irrigation". Source water from tailwater or subsurface flow from irrigation implies that these minor creeks and sloughs may be connected to the shallow groundwater. Shallow groundwater is recharged by precipitation and irrigation. The source of the water does not negate the fact that the shallow groundwater and surface water are interconnected. The major rivers have both gaining or losing reaches - they are also interconnected to the shallow groundwater, whereby the gaining reaches would also be recharged by shallow groundwater (that is also sourced from precipitation and irrigation return water). **Please further describe the relationship between the ephemeral and intermittent streams and depth to groundwater. The interconnection should not be discounted by stating that the source water is irrigation water.**

<u>Checklist Items 11 to 15, Identifying and Mapping GDEs (23 CCR §354.16)</u>

[Section 2.2.2.7 Groundwater Dependent Ecosystems (p. 2-140 to 2-143)]

- Identifying GDEs based on the question "Would the ecosystem not exist if groundwater levels were deeper" is an imprecise question that obscures the science-based identification of a GDE. **A better set of screening questions is 1) Is the NC polygon connected to a principal aquifer?; 2) What are the groundwater conditions in that aquifer?; and 3) Do we have sufficient data to characterize the groundwater conditions in the principal aquifer over seasonal and interannual timescales, so we can evaluate if groundwater levels are consistently deeper than 30 feet? See Worksheet 1 in TNC's GDE Guidance Document** (https://groundwaterresourcehub.org/public/uploads/pdfs/GDE_Guidance_Doc_Worksheet_1_2-1-18_pdf.pdf)
- **Please present or refer to a depth to groundwater contour map in this section, noting the following best practices for developing these contours**:
  - Are the wells used for interpolating depth to groundwater sufficiently close (<5km) to NC Dataset polygons to reflect local conditions relevant to ecosystems?
  - Is depth to groundwater contoured using groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape? This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make. It is better to assume that water surface elevations are constant in between wells, and then calculate

depth to groundwater using a DEM of the land surface to contour depth to groundwater.

- We have the following comments on the steps in the process for selecting NCCAGs that are GDEs (p. 2-140):
  - *Areas with a depth to groundwater less than 30 feet*: Please use care when considering rooting depths of vegetation. While Valley Oak (Quercus lobata) have been observed to have a max rooting depth of ~24 feet (https://groundwaterresourcehub.org/gde-tools/gde-rooting-depths-database-for-gdes/), rooting depths are likely to spatially vary based on the local hydrologic conditions available to the plant. Also, max rooting depths do not take capillary action into consideration, which is an important consideration since woody phreatophytes generally do not like to have their roots submerged in groundwater for extended periods of time, and hence can access groundwater at deeper depths. In addition, while it is likely to be true that shallow water availability is necessary to support the recruitment of saplings, hydraulic lift of groundwater to shallow depths has been observed in Quercus spp. Research on the symbiotic relationships between species and offspring is still emerging, but the assumption that a groundwater depth of 25 feet is "unlikely to support recruitment of new oak seedlings" is an unsubstantiated claim and falsely considered to be "conservative". This approach is not "conservative" and results in the elimination of more NC polygons because it negates the fact that there may be mature tree species that are likely connected to groundwater. **Regardless of life stage, if any plant or animal species in the NC polygons are connected to groundwater, then it needs to be mapped as a GDE.** The evaluation of potential effects on GDEs (e.g., the likelihood that regeneration is not occurring in the GDE due to groundwater levels being too deep for saplings) is to be performed when defining undesirable results in the Sustainable Management Criteria section of the GSP.
  - *Areas outside of the Yuba Goldfields:* The assumption that the NC polygons within the Yuba Goldfields are accessing a consistent supply from surface water from the Yuba River is insufficient. **Depth to groundwater data is needed within the Yuba Goldfields to confirm whether or not the NC polygons are connected groundwater.** GDEs rely on groundwater for some or all of their water requirements. It is not uncommon to see GDEs in California rely on both surface and groundwater, so to assume that all of the GDEs water requirement are being met by surface water in the Yuba River without using data to observe whether a connection to groundwater exists is inadequate.
  - *Areas not supplied with supplemental water*: The application of supplemental water to irrigated refuges and non-hard scape urban areas does not preclude the possibility that NC polygons could be accessing groundwater in addition to the supplied water. In the scientific literature, it is generally acknowledged that GDEs can rely on groundwater for some or all its requirements. GDEs can rely on multiple water sources simultaneously and at different temporal/spatial scales (e.g., precipitation, river water, reservoir water, soil

moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow). SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface". **We recommend that depth to groundwater contour maps are used to identify whether a connection to groundwater exists for the Managed Wetlands in Yuba.**

- *Areas not adjacent to irrigated fields*: Groundwater basins can be comprised of one continuous aquifer or multiple aquifers stacked on top of each other. Basins with a stacked series of aquifers may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow principal aquifers, that support springs, surface water, and groundwater dependent ecosystems. NC polygons adjacent to irrigated land can still potentially be reliant on shallow groundwater aquifers, thus excluding them based on their proximity to irrigated fields is inadequate. Also, GDEs can rely on multiple water sources simultaneously and at different temporal/spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow). **We recommend that depth to groundwater levels in the shallow principal aquifer be used as the evaluation criteria.**
- *Areas not dependent on proximity to reservoirs*: The presence of proximate surface water reservoirs does not preclude the possibility that NC polygons could be accessing groundwater in addition to the reservoir water. In the scientific literature, it is generally acknowledged that GDEs can rely on groundwater for some or all its requirements. GDEs can rely on multiple water sources simultaneously and at different temporal/spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow). SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface". **We recommend that depth to groundwater contour maps are used to identify whether a connection to groundwater exists for NC polygons.**
- *Areas not dependent on adjacent losing surface water bodies*: While losing conditions occur when groundwater levels are lower than the stage in the stream, the degree to which losing conditions occur will depend on the groundwater level gradient between them. Losing conditions also vary in time, especially over different seasons. Even if a stream or river reach is losing, the riparian vegetation may still be accessing groundwater, and hence be identified as a GDE. **We highly recommend that depth to groundwater levels under the NC polygons be used as the evaluation criteria, since access to groundwater could be occurring in/near losing reaches.** If riparian vegetation in losing reaches are 100% of the

time using surface water (especially if the groundwater is consistently deep), it is not a GDE.

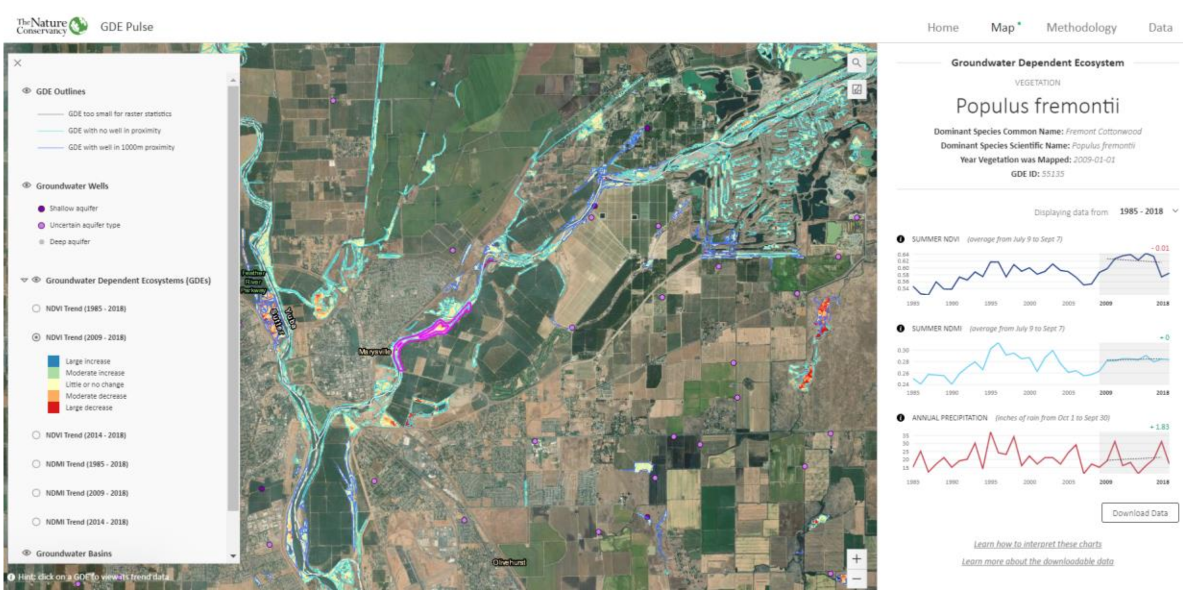
  - *Areas continuing to be NCCAGs*: **Please indicate what aerial imagery was used to identify Developed Areas in the NC Dataset.**

- The NC dataset is a starting point for GSAs to identify GDEs in their basin. Thank you for documenting the removal of NC polygons when identifying GDEs in the basin. However, please also specify whether any local information/data sources were used to identify missing GDEs (e.g., springs, seeps) from the NC dataset that may need to be *added* to the GDE basin map (Figure 2-90). **In the text or on the Figure, please cite the acreage of GDEs retained and removed. The basin's GDE shapefile, which is submitted via the SGMA Portal, should include two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).**

Checklist Items 16 to 20, Describing GDEs (23 CCR §354.16)

[Section 2.2.2.7 Groundwater Dependent Ecosystems (p. 2-140 to 2-143)]

- **Please provide information on the historical or current groundwater conditions in the GDEs or the ecological conditions present**. Refer to GDE Pulse (https://gde.codefornature.org; See Attachment D of this letter for more details) or any other locally available data (e.g., leaf area index, evapotranspiration or other data) to describe depth to groundwater trends in and around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in the Yuba Subbasins:



- **Please consider providing an ecological inventory (see Appendix III, Worksheet 2 of the GDE Guidance) for potential GDEs that includes the vegetation types or habitat types.**
- **Please identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat were found in or near any of the GDEs since some organisms rely on uplands and wetlands during different stages of their lifecycle**. Resources for this include TNC's list of freshwater species included in Appendix C of the GSP, the Critical Species Lookbook, and CDFW's CNDDB database.

Checklist Item 26 – Measurable Objectives (23 CCR §354.30) and Checklist Item 27-29 – Minimum Thresholds (23 CCR §354.28)

[Section 4.4.1 Quantitative Sustainable Management Criteria for Chronic Lowering of Groundwater Levels (p. 4-11)]

- The GSP states (p. 4-12): "Conditions relevant to GDEs are not incorporated into the quantification of these [sustainable management] criteria, as GDE access shallow groundwater conditions more likely to be driven by contributions from nearby irrigated agriculture or surface water bodies than deeper groundwater pumping, as discussed in Section 2.2.2.7." This statement disregards the fact that GDEs can rely on multiple water sources simultaneously and at different temporal/spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow). As stated above under Checklist Items 5-7, the shallow portion of the aquifer is part of the principal aquifer. Shallow groundwater supporting GDEs must be protected by Sustainable Management Criteria. **Please include a discussion of GDEs in this section and explain how the Measurable Objectives, Interim Milestones, and Minimum Thresholds will help achieve the Sustainability Goal as it pertains to the environment.**
- Minimum thresholds presented in Table 4-1 for chronic lowering of groundwater levels (p. 4-16) allow for a decrease of groundwater elevations to elevations of 75 feet below groundwater surface, deeper than historic lows. GDEs relying on shallow groundwater are likely to experience undesirable results well before groundwater levels reach these depths. **Please show GDE locations on a map of the representative monitoring wells. Please set Sustainable Management Criteria for Chronic Lowering of Groundwater Levels that protect GDEs.**

Checklist Item 30-46 – Undesirable Results (23 CCR §354.26)

[Section 4.3.1 Undesirable Results for Chronic Lowering of Groundwater Levels (p. 4-4)]

- The GSP states (p. 4-4): "[W]ithin each individual subbasin, undesirable results are considered to occur during GSP implementation when more than 25% of representative monitoring wells (4 of 13 wells in the North Yuba Subbasin; 5 of 18 wells in the South Yuba Subbasin) used to monitor groundwater levels fall below their minimum elevation thresholds for two consecutive years at each location." The use of 25 percent to define an undesirable result does not allow for the occurrence of low water levels in one area, such as near a GDE, to be an Undesirable Result. Damage to GDEs can occur within a relatively short period of time and can be irreversible, leading to a permanent loss. A percentage violation trigger is therefore an insufficient method to prevent undesirable results to environmental users of groundwater. **Please elaborate on how the exceedance criteria would be applied in a way that is protective of significant and unreasonable harm to GDEs.** A procedure could be included for violation of minimum thresholds that includes early identification of potential GDE impacts and appropriate response actions. This could be accomplished efficiently and cost-effectively using remote sensing tools, such as GDE Pulse.

- **Please provide more specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs.** The definition of 'significant and unreasonable' is a qualitative statement that is used to describe when undesirable results would occur in the basin, such that a minimum threshold can be quantified. Potential effects on all beneficial users of groundwater in the basin need to be taken into consideration. According to the California Constitution Article X, §2, water resources in California must be "put to beneficial use to the fullest extent of which they are capable". **Please identify appropriate biological indicators that can be used to monitor potential impacts to environmental beneficial users due to groundwater conditions. Please elaborate on the use of a tool such as GDE Pulse for monitoring the health of GDEs over time.**

[Section 4.3.6 Undesirable Results for Depletions of Interconnected Surface Water (p. 4-7)]

- The GSP states (p. 2-136): "The YGM and the groundwater and surface water monitoring network provide sufficient information to characterize the interconnected surface water systems." However, the GSP proposes using *deep* groundwater levels as a proxy for depletion of interconnected surface waters in Section 4.3.6.4, despite the statement on p. 2-136 that "...all surface water systems are thought to be interconnected with at least shallow groundwater, based on currently available co-located surface water stage data and shallow groundwater level data." Shallow groundwater data has been identified as a data gap in the GSP, and thus it is assumed that the shallow groundwater data to be acquired in the future could be used to improve the groundwater model. **TNC recommends utilizing the shallow groundwater data collected under future monitoring to improve the modeled relationship between interconnected surface water and groundwater. Instead of using groundwater levels as proxy for depletion of interconnected surface waters, please establish Sustainable Management Criteria for interconnected surface waters based on the rate of volume of surface water depletions caused by groundwater use, per the SGMA regulations.**
- The GSP states (p. 4-9): "The minimum threshold for chronic declines of groundwater levels are considered sufficiently protective to ensure significant and unreasonable effects on beneficial uses of the Yuba River will be prevented, and groundwater levels are used as a proxy for depletions," and makes the same statements for the Feather and Bear Rivers. However, not enough evidence is

presented to establish the correlation between depletions of interconnected surface water and groundwater levels. Furthermore, there is no presented relationship between the groundwater elevation proxy and the actual expected undersirable results that could impact GDEs and environmental beneficial users of surface water. The cause-effect relationship between surface water levels (or groundwater elevations by proxy) and the biological responses that could result in significant and unreasonable impacts to ISWs and GDEs depends on a number of factors, and this relationship is not characterized or discussed. **Please elaborate on what Undesirable Results for environmental beneficial users of groundwater and interconnected surface waters could be expected when interconnected surface water is depleted. The Yuba, Bear, and Feather rivers contain protected habitat for Central Valley steelhead and fall-run Chinook salmon. Please develop sustainable management criteria for interconnected surface waters that protect instream habitat conditions for fish and wildlife.**

<u>Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)</u>

[Section 3.2.1 Groundwater Level Monitoring Network (p. 3-2)]

- TNC acknowledges and appreciates the recognition of data gaps in the groundwater level monitoring network (p. 3-10) and the continued GDE and depletion evaluation described under Projects and Management Actions (p. 5-7). **Please further detail plans to install additional shallow groundwater monitoring wells near potential GDEs in the basin and along ISWs. Please provide specific recommendations for shallow monitoring wells, stream gauges, and nested/clustered wells to inform an adequate analysis.**

<u>Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)</u>

[Section 5 Projects and Management Actions (p. 5-1)]

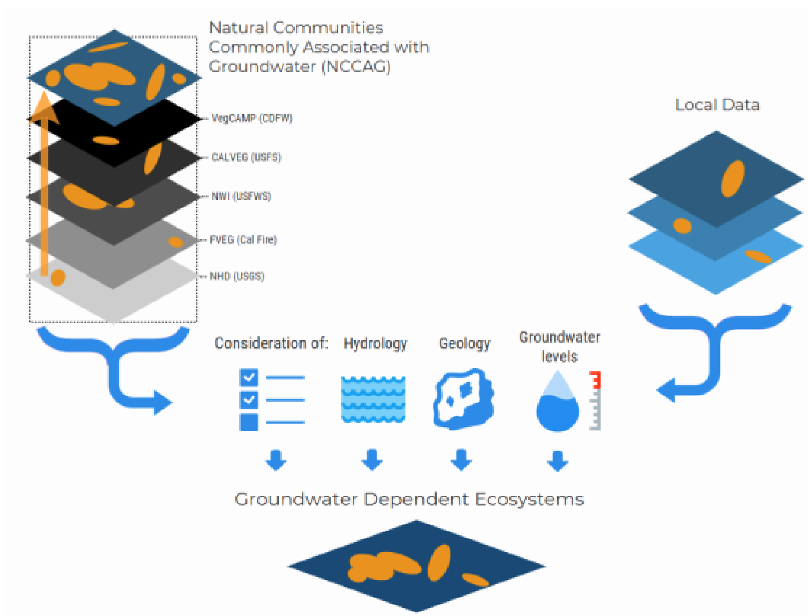
- TNC applauds the inclusion of the project and management actions described in Section 5.1.7, Continued GDE and Depletion Evaluation. Specifically, we acknowledge and appreciate the proposed use of TNC's GDE Pulse Tool to analyze groundwater level data and remote sensing data on vegetative cover to explore the relationship between groundwater levels and GDE health.
- **If and when future projects are planned, please include environmental benefits and multiple benefits as criteria for assessing project priorities.** Environmental users and uses should be considered in establishing new projects. In addition, consistent with existing grant and funding guidelines for SGMA-related work, consideration may be given to multi-benefit projects that can address water quantity as well as providing environmental benefits or benefits to disadvantaged communities.
- **Please consider adding Management Actions which include education and outreach for protection of GDEs and ISWs.**

Attachment C

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[3] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[4]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[3] *NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/*

[4] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[5]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[6] on the Groundwater Resource Hub[7], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[5] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[6] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[7] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

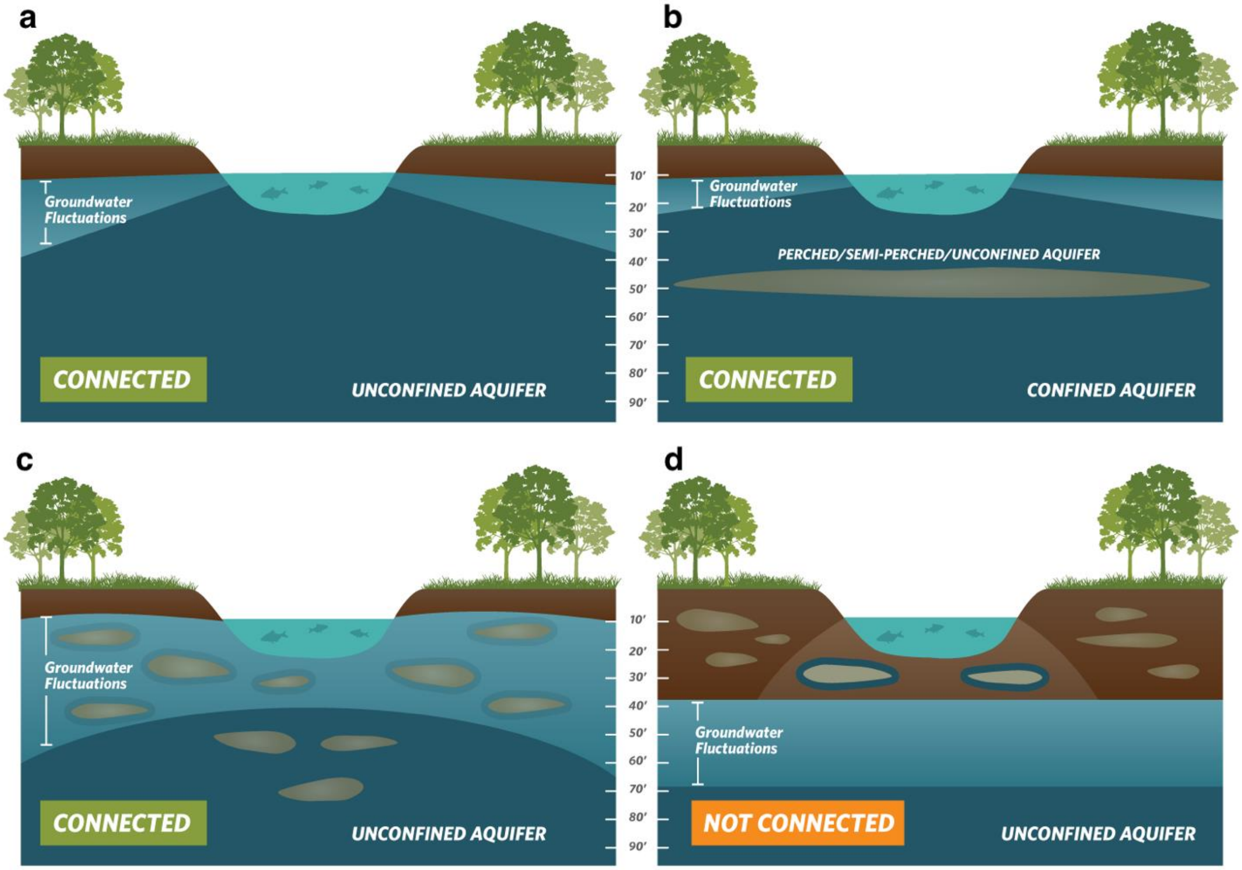

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[8] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[9] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[10] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[11]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

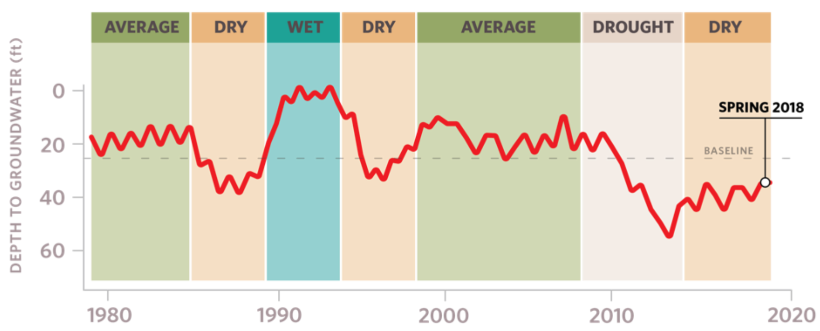

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[8] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[9] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[10] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[11] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[12], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

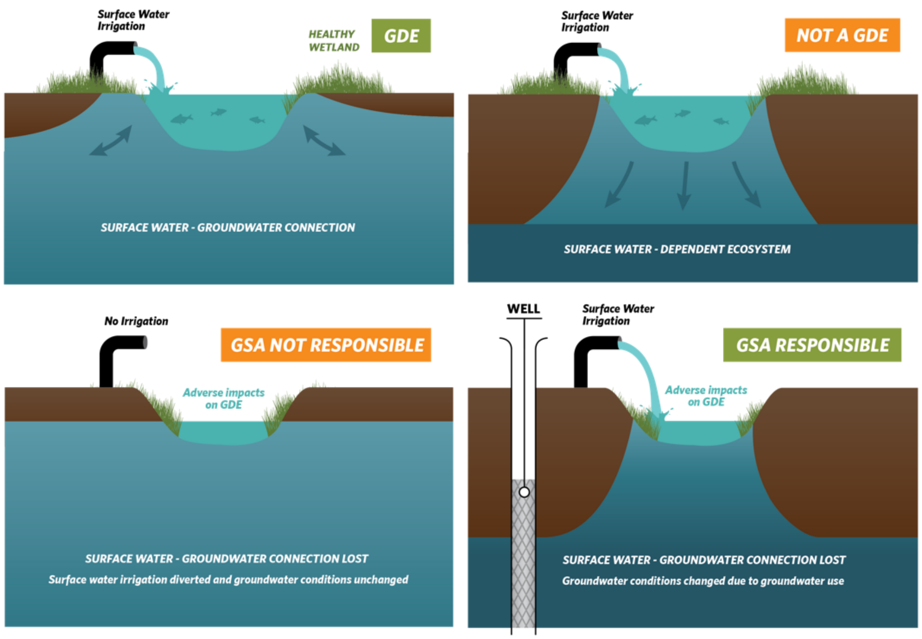

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[12] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

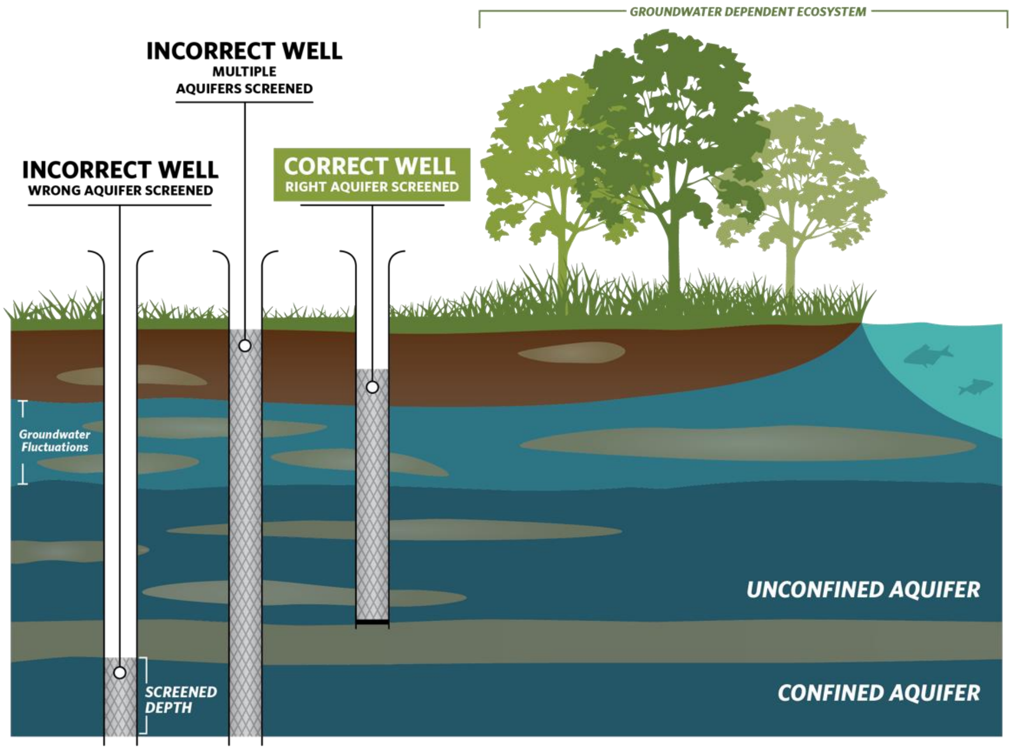

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[13] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

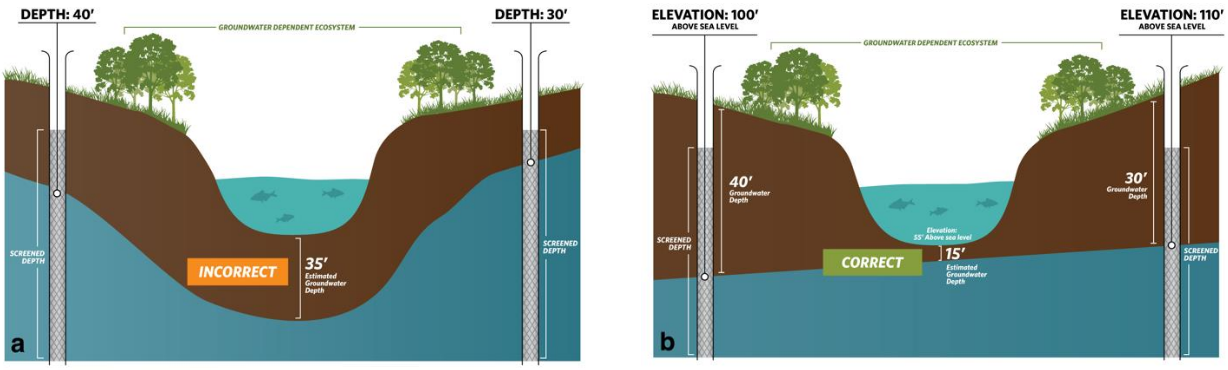

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

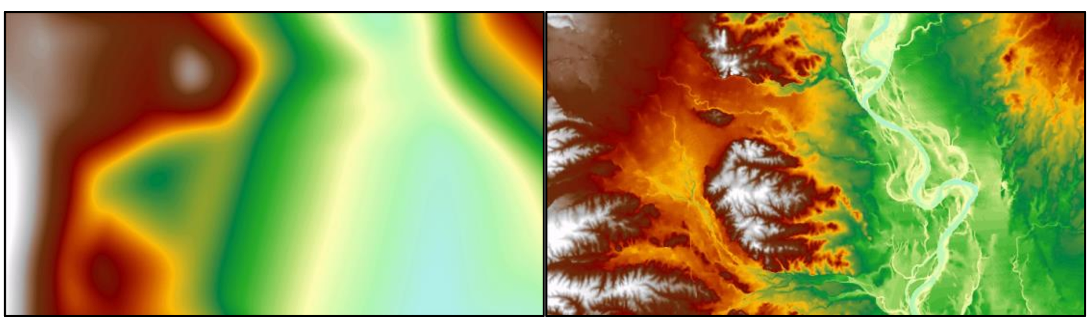

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[13] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment D

Mapping Likely Interconnected Surface Water

The Nature Conservancy, California, May 2020

Sustainable groundwater management in California requires an understanding of how groundwater pumping affects surface water features. Groundwater seeps into many river and lake beds in California, providing a steady source of cool clean water. This source of water is crucial for people and nature because it remains steady throughout the year even after the winter rains stop. Under SGMA, ISW is defined as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (Groundwater Sustainability Plan Emergency Regulations). SGMA requires special treatment of ISW, but in many parts of the state, ISW is poorly understood. This set of maps displays rivers and streams that are likely ISW, using groundwater depth as a proxy to determine ISW.

Methods and Data Sources:

The groundwater elevation data, available for Spring 2011-2012, and Spring and Fall 2013-2018, comes from the California Department of Water Resources (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). These data are represented as continuous raster layers that approximates "feet above or below mean sea level" based on groundwater well measurements. According to the documentation online, groundwater level measurements were selected based on measurement date and well construction information (where available) and are intended to approximate the groundwater levels in the unconfined to uppermost semi-confined aquifers. Each of the raster layer has a different extent, but all of them are limited to the Central Valley. To determine ISW, we used ArcGIS software to calculate the average, minimum, and maximum groundwater elevation. Next, we subtracted the elevation grids from the statewide 30-meter resolution digital elevation model (DEM). The resulting layers represent the mean, minimum, and maximum *depth* to groundwater, expressed in feet below the ground surface. Finally, we used flowline data from the National Hydrography Dataset Plus (https://nhdplus.com/NHDPlus/NHDPlusV2_home.php) to assign groundwater depth values to rivers and streams. We developed a new shapefile of stream segments with three new attributes: mean, minimum, and maximum groundwater depth.

The map splits groundwater depth into four categories:

- Connected – Gaining. Groundwater depth is at or above stream surface levels and thus is likely flowing into the surface water body.
- Connected – Losing. Groundwater depth is between 0 and 20 ft. of the stream surface level and thus is likely receiving water from the water body through a continuous saturated zone.
- Uncertain. Groundwater depth between 20 and 50 ft. below the stream surface is labeled as uncertain and may or may not be connected to surface water.
- Likely Disconnected. Groundwater depth greater than 50 ft. below the stream surface is likely disconnected from surface water.

There is no comprehensive data on stream depth, we analyzed all the gage height measurements from USGS gages in the Central Valley. For some (17%) of the stream gages, the average gage height measurement was greater than 20 feet. This is only a proxy for stream

height because gage height is measured from a reference elevation which may or may not be the bottom of the stream bed. Based on this information, we chose a break point of 20ft between losing and uncertain streams.

Interconnected Surface Water: Minimum Groundwater Depth (2011-2018)

Yuba Subbasins GSP

Legend

- Groundwater Sustainability Agency (GSA)
- No groundwater depth data available
- Rivers and streams with no depth data (72.8 miles)
- Groundwater Elevation Monitoring Point

Minimum Groundwater Depth

- Connected - Gaining: Groundwater at or above stream surface (39.2 miles)
- Connected - Losing: Groundwater within 20 feet of stream surface (187.2 miles)
- Uncertain*: Groundwater within 20-50 feet of stream surface (48.3 miles)
- Likely Disconnected*: Groundwater greater than 50 feet below stream surface (2.4 miles)

**Streams could be connected to riparian or perched aquifers or shallow aquifers that are poorly characterized. More data are needed to confirm disconnected status.*

5-021.61_SouthYuba

Data Sources:
CA Dept. of Water Resources Groundwater Elevation Data, gis.water.ca.gov/app/gicima/
NHD Plus V2 Streams, nhdplus.com/NHDPlus/

November 13, 2021

Enterprise Anderson Groundwater Sustainability Agency

Submitted via email: Lyna.Black@jacobs.com

Re: Public Comment Letter for Anderson Subbasin Draft GSP

Dear Lyna Black,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Anderson Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Anderson Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Anderson Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes
The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP describes and maps tribal lands in the subbasin (Figure 2-2). The GSP provides information on DACs and Severely Disadvantaged Communities (SDACs) within the subbasin, including identification by name and location a map (Figures 1-2 to 1-4). However, the GSP fails to clearly state the population of each DAC or include the population dependent on groundwater as their source of drinking water in the subbasin.

While the plan provides a density map of domestic wells in the subbasin (Figure 2-6), the GSP fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin. This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the subbasin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS

- Provide the population of each identified DAC. Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

- Include a map showing domestic well locations and average well depth across the subbasin.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

Interconnected Surface Waters
The identification of Interconnected Surface Waters (ISWs) is **incomplete**. To assess ISWs in the subbasin, water table elevations as simulated by the EAGSA Model (described in GSP Appendix F) were averaged over 1999-2018 to develop a seasonal high-water-table distribution for the month of April and compared to the stream bottom elevations. This process was utilized to evaluate where modeled streams and the water table were in direct connection. The resulting map of interconnected reaches in the subbasin is presented on Figure 3-17.

The ISW section of the GSP could be further improved by including discussion of data gaps for ISWs. We recommend that the GSP considers any segments with data gaps as potential ISWs and clearly marks them as such on maps provided in the GSP.

RECOMMENDATIONS

- Figure 3-17 showing interconnected reaches could be improved by clarifying the legend labels and colors used for the stream reaches. For example, reaches of the Sacramento River are shown as either a thick blue line or a thin blue line inside a green border. It is unclear what the difference is since the text states that the entire length of the Sacramento River is interconnected.

- Describe data gaps for the ISW analysis. We recommend that the GSP considers any segments with data gaps as potential ISWs and clearly marks them as such on maps provided in the GSP.

Groundwater Dependent Ecosystems
The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). Potential GDEs were identified in areas overlying groundwater within 30 feet of land surface based on April 2018 groundwater conditions. Even though the GSP points out that this is conservative because spring represents seasonal high groundwater conditions, we recommend using data from multiple seasons and water year types to determine the range of depth to groundwater around NC dataset polygons. We would also like to see additional discussion and use of groundwater data from the pre-SGMA benchmark date of 2015 where available to determine which GDE units are connected to groundwater.

The GSP states that 29 percent of the NC vegetation in the subbasin is Valley Oak. We recommend that an 80-foot depth-to-groundwater threshold be used when inferring whether Valley Oak polygons in the NC dataset are likely reliant on groundwater. This recommendation is based on a recent correction in TNC's rooting depth database,[2] after finding a typo in the max rooting depth units for Valley Oak. This resulted in a specific change in the max rooting depth of Valley Oak from 24 feet to 24 meters (80 feet). For all other phreatophytes, we continue to recommend that a 30-foot depth-to-groundwater threshold be used when inferring whether all other NC dataset polygons are likely reliant on groundwater.

The GSP does not provide an inventory of flora and fauna in the subbasin, except to list the main vegetation types in the subbasin's GDEs. No discussion of threatened or endangered species was provided.

[2] TNC. 2021. Plant Rooting Depth Database. Available at: https://groundwaterresourcehub.org/sgma-tools/gde-rooting-depths-database-for-gdes/

RECOMMENDATIONS

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as Valley Oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether Valley Oak polygons from the NC Dataset are connected to groundwater. It is important to emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

- Discuss data gaps for GDEs. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- Provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin and note any threatened or endangered species (see Attachment C in this letter for a list of freshwater species located in the Anderson Subbasin).

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[3,4] The integration of these ecosystems into the water budget is **insufficient**. The water budget did not include the current, historical, and projected demands of native vegetation and managed wetlands. The GSP states that 6% of the subbasin (480 acres) is comprised of managed wetlands (p. 2-5; mapped on Figure 2-4). The omission of explicit water demands for native vegetation and managed wetlands is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

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[3] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[4] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

RECOMMENDATION
● Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation and managed wetlands.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development
Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Communications & Engagement Plan (Appendix C-1).[5]

The GSP notes targeted engagement with tribal stakeholders (Redding Rancheria) and environmental stakeholders (The Nature Conservancy and Department of Fish & Wildlife) during the GSP development process via phone calls, email notifications, and targeted briefings and interviews. However, we note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement through outreach materials, soliciting comments and promoting meetings through partnering organizations' newsletters, public workshops, GSA Board meetings, targeted briefings, individual interviews to clarify written comments, and providing the online GSP public comment portal. Specific details of outreach and engagement targeted to DACs include providing Spanish-language versions of outreach materials and announcements, posting flyers in community health centers, engaging with partner organizations such as the Rural Community Assistance Corporation, and training that serves target DAC and Spanish-speaking populations in Redding and Anderson. However, the GSP does not make clear whether DACs are represented on a GSA Advisory Committee or Board, or how their needs and concerns were otherwise considered and incorporated during the GSP development process.

- Aside from the continuation of engagement strategies used during the GSP development process, the GSP does not include a detailed plan for continual opportunities for engagement through the *implementation* phase of the GSP that is specifically directed to DACs, tribes, domestic well owners, and environmental stakeholders.

RECOMMENDATIONS
● In the Communications & Engagement Plan, describe active and targeted outreach to engage all stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

[5] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the subbasin within the GSP.[6]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[7,8,9]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP uses a model simulation entitled 'Increased Groundwater Use Scenario' to examine impacts on beneficial users of groundwater. Minimum thresholds are established as follows (p. 6-6): *"The MTs for chronic lowering of groundwater levels were selected as the lower of either the historical minimum measured groundwater elevation or the minimum projected groundwater elevation under the Increased Groundwater Use Scenario at each RMP."*

To examine impacts of minimum thresholds on domestic wells, the GSP states (p. 6-9): *"The MTs for chronic lowering of groundwater levels were compared to the range of public and private well depths in the Anderson Subbasin to evaluate whether the selected MTs are reasonably protective of these beneficial users."* The GSP continues (p. 6-9): *"The comparison showed that if groundwater levels consistent with those projected in October 2069 under the Increased Groundwater Use Scenario were to occur, then 78 percent of domestic wells in the Anderson Subbasin would have at least 10 feet of water in them."* However, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold, and whether the undesirable results are consistent with the Human Right to Water policy,[10] especially given the absence of a domestic well mitigation plan in the GSP.

In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs, domestic well owners, or tribes when defining undesirable results, nor does it describe how the plan will avoid significant and unreasonable impacts on these beneficial users.

For degraded water quality, minimum thresholds are established for constituents of concern (COCs) as zero additional exceedances of the maximum contaminant level (MCL) or secondary MCL at the representative monitoring points (RMPs). This information suggests that exceedances

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[6] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[7] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[8] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[9] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[10] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

from other existing sites are acceptable under this GSP. However, any exceedance of MCL or SMCL is a violation of the state's water quality law and is not permitted. Additionally, according to the state's anti-degradation policy,[11] high water quality should be protected and is only allowed to worsen if a finding is made that it is in the best interest of the people of the State of California. No analysis has been done and no such finding has been made.

The GSP sets measurable objectives identical to minimum thresholds. The GSP states (p. 6-23): *"The EAGSA has established the MOs for degraded water quality in the Anderson Subbasin as the existing distribution of groundwater impairments (i.e., no change from current conditions)."* The exceedance of minimum thresholds is supposed to trigger additional actions but since minimum thresholds are identified as measurable objectives, it is unclear what action is triggered.

Section 3.2.5 of the GSP (Water Quality) and Appendix E (Anderson Subbasin Groundwater Quality Dataset) present water quality data and discuss trends for several other constituents, including naturally occurring water quality constituents and constituents related to human activity including fuel-related compounds. No SMC have been established for these additional constituents, however. SMC should be established for all COCs in the subbasin impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

Degraded Water Quality

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when defining undesirable results for degraded water quality.[12] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[13]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs, drinking water users, and tribes.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that are impacted or exacerbated by groundwater use and/or management.

- Set measurable objectives at lower levels than minimum thresholds (i.e., indicative of better water quality).

[11] Anti-degradation Policy https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf

[12] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[13] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

- Set minimum thresholds that do not allow water quality to degrade to levels at or above the MCL trigger level.

Groundwater Dependent Ecosystems and Interconnected Surface Waters
For chronic lowering of groundwater levels, minimum thresholds are established in the same manner as stated above under Disadvantaged Communities and Drinking Water Users (i.e., established as the lower of two elevations). The same model simulation described above (Increased Groundwater Use Scenario) was used to examine impacts on environmental beneficial users of groundwater.

The GSP states (p. 6-10): *"An assessment of potential effects of the MTs on ecological beneficial users was performed by comparing potential impacts on the extent of GDEs overlying areas of groundwater within 30 feet bgs. Figure 6-5 presents a comparison of the extent of shallow groundwater (depth to water less than or equal to 30 feet bgs) between spring 2018 and a dry month during the projection period under the Increased Groundwater Use Scenario (fall 2069). The latter condition was selected as a conservative estimate of potential depth to water under a multi-year drought and substantially higher than current groundwater pumping within the basin (i.e., a "worst-case" scenario). As shown on Figure 6-5, the lateral extents of groundwater within 30 feet of ground surface in the south/southeastern of the subbasin where most GDE communities thrive are less in fall 2069 under the Increased Groundwater Use Scenario as compared to spring 2018. The total GDE acreage within the 30-feet-to-groundwater zone is approximately 3 percent less (approximately 3,880 acres in fall 2069 compared to 4,000 acres in spring 2018). Therefore, the selected MTs are considered protective of ecological beneficial users."* However, by simply providing the percentage difference in GDE coverage from current conditions to future worst-case conditions, the cumulative impacts to ecosystems under this worst-case scenario are not discussed in the GSP. By assuming that GDEs can be sustained on historic low groundwater levels (or lower) and the subbasin is allowed to operate at or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the adverse impacts (such as widespread tree mortality or loss of critical habitat for aquatic species) can exceed what had occurred prior to 2015.

For depletions of interconnected surface water, the GSP uses groundwater elevations by proxy to establish SMC. The GSP uses the Increased Groundwater Use Scenario model simulation to examine whether significant and unreasonable conditions would likely result due to groundwater pumping under this scenario. The GSP estimates that Sacramento River streamflow would be reduced by 1.8% and Cottonwood Creek Streamflow would be reduced by 7.1% under the Increased Groundwater Use Scenario. The GSP states (6-21): *"Because the estimated depletion of interconnected surface water in the Sacramento River is projected to be within the measurement error of its stream gauge, aquatic species (such as salmon) would not be affected."* However, no conclusions are drawn about Cottonwood Creek streamflow, and whether depletions of interconnected surface water would cause significant and unreasonable conditions. Furthermore, because the GSP does not provide or discuss the aquatic species in the subbasin except for the single mention in the quoted sentence (see Attachment C for a list of environmental users in the subbasin), it has not determined if proposed minimum thresholds avoid significant and unreasonable effects on these surface water beneficial users, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin.[14] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[15]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[16] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,17]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[18] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more

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[14] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[15] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[16] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[17] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[18] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

on groundwater during times of drought.[19] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using RCP 8.5 and the HadGEM2-ES Global Climate Model. However, the GSP does not consider other extreme climate scenarios in the projected water budget. We encourage you to consider other GCM projections. While HadGEM2-ES may better represent median conditions, other models may better capture other statistics relevant for your subbasin and may reveal valuable information to account for uncertainty. In addition, the GSP should clearly and transparently incorporate extremely wet and dry scenarios or select more appropriate extreme scenarios for their subbasin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP integrates climate change into key inputs (e.g., changes in precipitation and evapotranspiration) of the projected water budget. However, water imported via the Central Valley Project should also be adjusted for climate change and incorporated into the surface water flow inputs of the projected water budget. The sustainable yield is calculated based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of extreme climate scenarios and the omission of projected climate change effects on imported water flow inputs, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, tribes, and domestic well owners.

RECOMMENDATIONS

- Consider other GCM projections to account for uncertainty beyond median statistics.
- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change into surface water flow inputs, including imported water, for the projected water budget.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, tribes, GDEs, and ISWs in the subbasin. These beneficial users may remain unprotected by the GSP

[19] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[20]

Figure 5-1 (Groundwater Level Monitoring Network) shows insufficient representation of DACs, drinking water users, and tribes for groundwater elevation monitoring. Figure 5-2 (Groundwater Quality Well Network) shows insufficient representation of DACs and drinking water users for water quality monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater.

The GSP provides some discussion of data gaps for GDEs in Section 8.3.1 (Groundwater Level Data Gaps), but does not provide specific plans, such as locations or a timeline, to fill the data gaps.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, tribes, and GDEs to clearly identify monitored areas.
- Increase the number of RMPs in the shallow aquifer across the subbasin as needed to map ISWs and adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, tribes, GDEs, and ISWs when identifying new RMPs.
- Ensure groundwater elevation and water quality RMPs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, tribes, and GDEs.
- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient** due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, drinking water users, and tribes. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

While the GSP (Section 7.1.3) describes the environmental benefits of Storm Water Resources Plans, the GSP fails to describe this or other project's explicit benefits or impacts to other beneficial users, such as DACs. The GSP also fails to include a domestic well mitigation program to avoid significant and unreasonable loss of drinking water.

[20] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

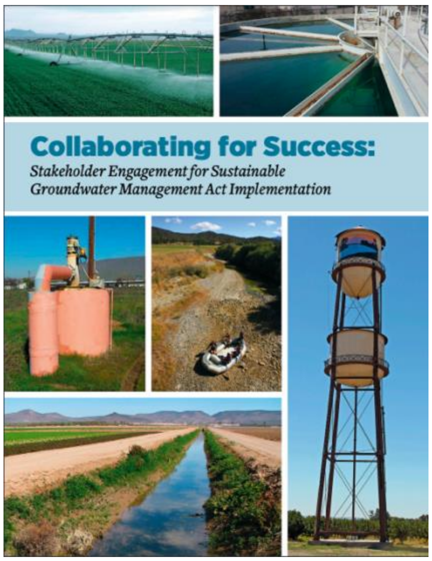
RECOMMENDATIONS
● For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program. ● For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts. ● Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[21] ● Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[21] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



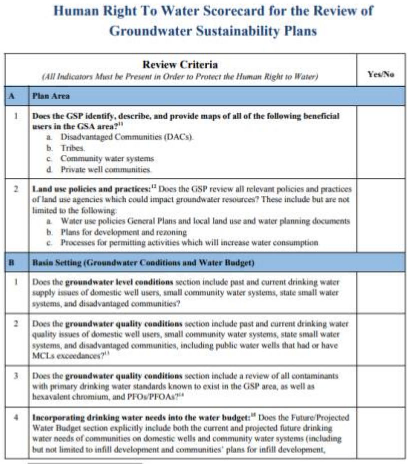
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

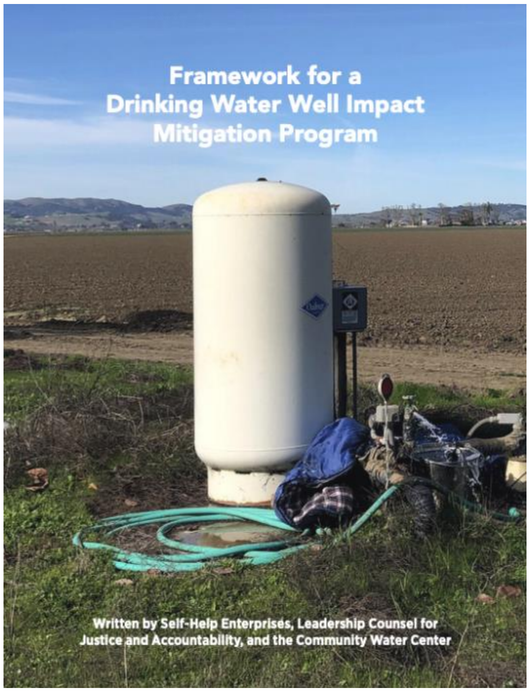


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

Review Criteria (All Indicators Must be Present in Order to Protect the Human Right to Water)		Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

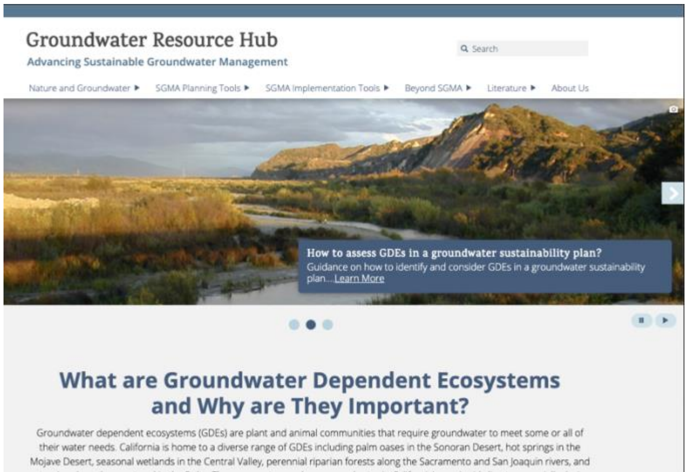
The [Human Right to Water Scorecard] was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



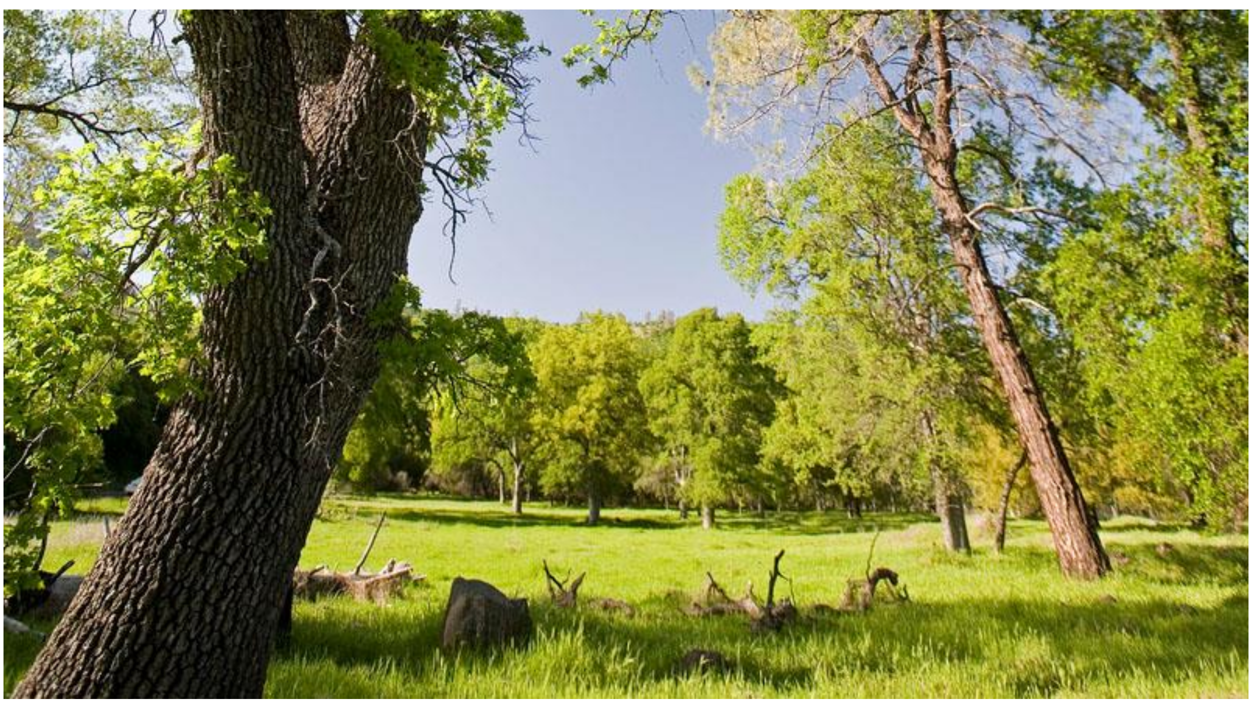
The [Drinking Water Well Impact Mitigation Framework] was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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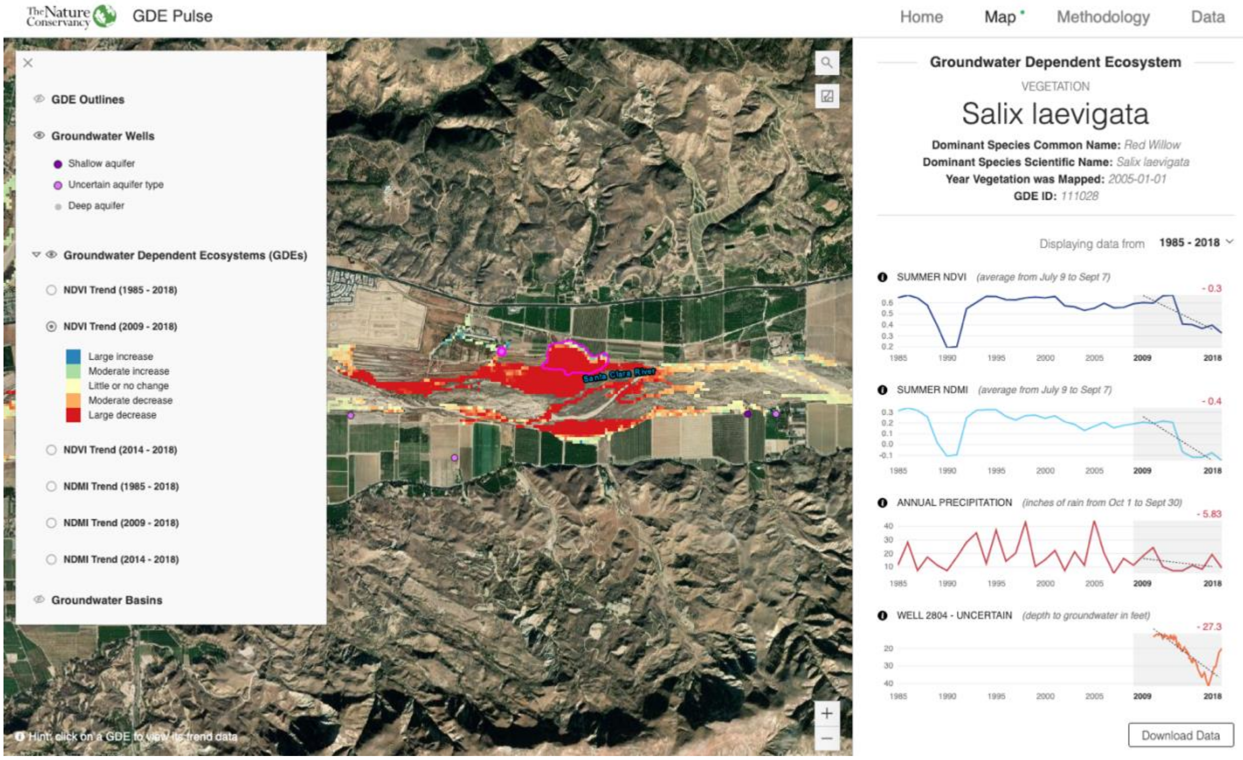
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

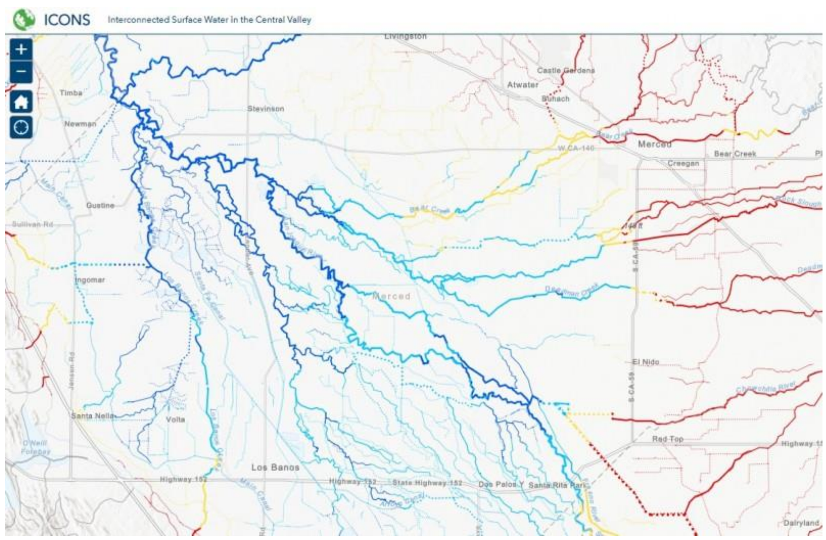
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Anderson Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Anderson Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Anas platyrhynchos	Mallard			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Butorides virescens	Green Heron			
Egretta thula	Snowy Egret			
Megaceryle alcyon	Belted Kingfisher			
FISH				
Oncorhynchus mykiss - NC summer	Northern California coast summer steelhead	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - NC winter	Northern California coast winter steelhead	Threatened		Near-Threatened - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma gracile	Northwestern Salamander			
Anaxyrus boreas boreas	Boreal Toad			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Dicamptodon tenebrosus	Pacific Giant Salamander			
Rana aurora	Northern Red-legged Frog		Special Concern	ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Taricha rivularis	Red-bellied Newt			ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Ablabesmyia spp.	Ablabesmyia spp.			
Ambrysus spp.	Ambrysus spp.			
Antocha spp.	Antocha spp.			
Apedilum spp.	Apedilum spp.			
Argia spp.	Argia spp.			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Calineuria californica	Western Stone			
Callibaetis spp.	Callibaetis spp.			
Centroptilum spp.	Centroptilum spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Dytiscidae fam.	Dytiscidae fam.			
Ephydridae fam.	Ephydridae fam.			

Eubrianax edwardsii				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Glossosoma spp.	Glossosoma spp.			
Gomphidae fam.	Gomphidae fam.			
Gumaga spp.	Gumaga spp.			
Haploperla chilnualna	Yosemite Sallfly			
Helichus spp.	Helichus spp.			
Helicopsyche spp.	Helicopsyche spp.			
Heptageniidae fam.	Heptageniidae fam.			
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila spp.	Hydroptila spp.			
Isonychia velma	A Mayfly			
Isoperla spp.	Isoperla spp.			
Lepidostoma spp.	Lepidostoma spp.			
Macromia magnifica	Western River Cruiser			
Malenka spp.	Malenka spp.			
Marilia flexuosa	A Caddisfly			
Maruina lanceolata				Not on any status lists
Mesovelia spp.	Mesovelia spp.			
Micropsectra spp.	Micropsectra spp.			
Microtendipes spp.	Microtendipes spp.			
Mideopsis spp.	Mideopsis spp.			
Mystacides spp.	Mystacides spp.			
Nilothauma spp.	Nilothauma spp.			
Oecetis spp.	Oecetis spp.			
Ophiogomphus bison	Bison Snaketail			
Ophiogomphus spp.	Ophiogomphus spp.			
Optioservus spp.	Optioservus spp.			
Ordobrevia nubifera				Not on any

				status lists
Paraleptophlebia spp.	Paraleptophlebia spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Pentaneura spp.	Pentaneura spp.			
Petrophila spp.	Petrophila spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			
Protoptila spp.	Protoptila spp.			
Psectrocladius spp.	Psectrocladius spp.			
Psephenus falli				Not on any status lists
Pseudochironomus spp.	Pseudochironomus spp.			
Pteronarcys spp.	Pteronarcys spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhithrogena spp.	Rhithrogena spp.			
Rhyacophila spp.	Rhyacophila spp.			
Sialis spp.	Sialis spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sweltsa spp.	Sweltsa spp.			
Tanytarsus spp.	Tanytarsus spp.			
Tipulidae fam.	Tipulidae fam.			
Tricorythodes spp.	Tricorythodes spp.			
Zaitzevia spp.	Zaitzevia spp.			
MAMMALS				
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
MOLLUSKS				

Ferrissia spp.	Ferrissia spp.			
PLANTS				
Arundo donax	NA			
Carex densa	Dense Sedge			
Pleuropogon hooverianus	North Coast False Semaphore Grass		Threatened	CRPR - 1B.1
Pluchea odorata odorata	Scented Conyza			
Solidago lepida salebrosa				Not on any status lists

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

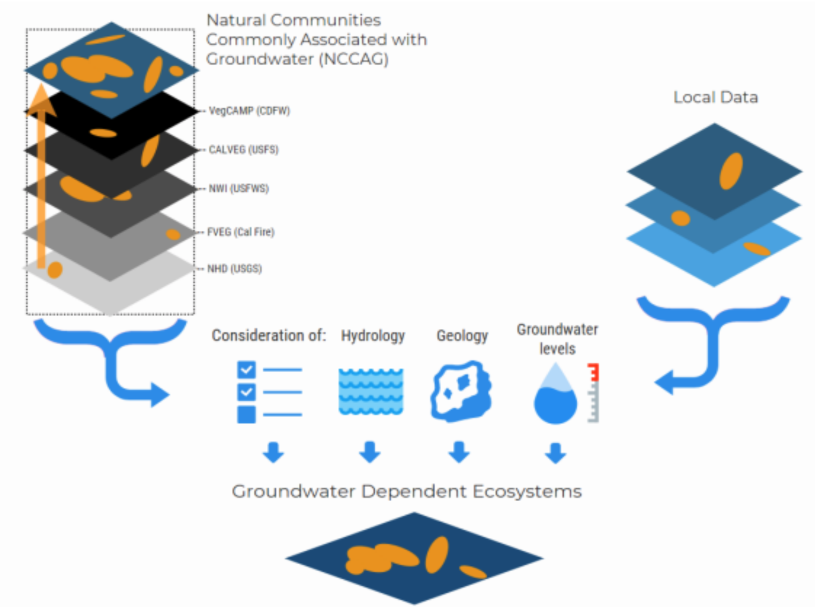


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

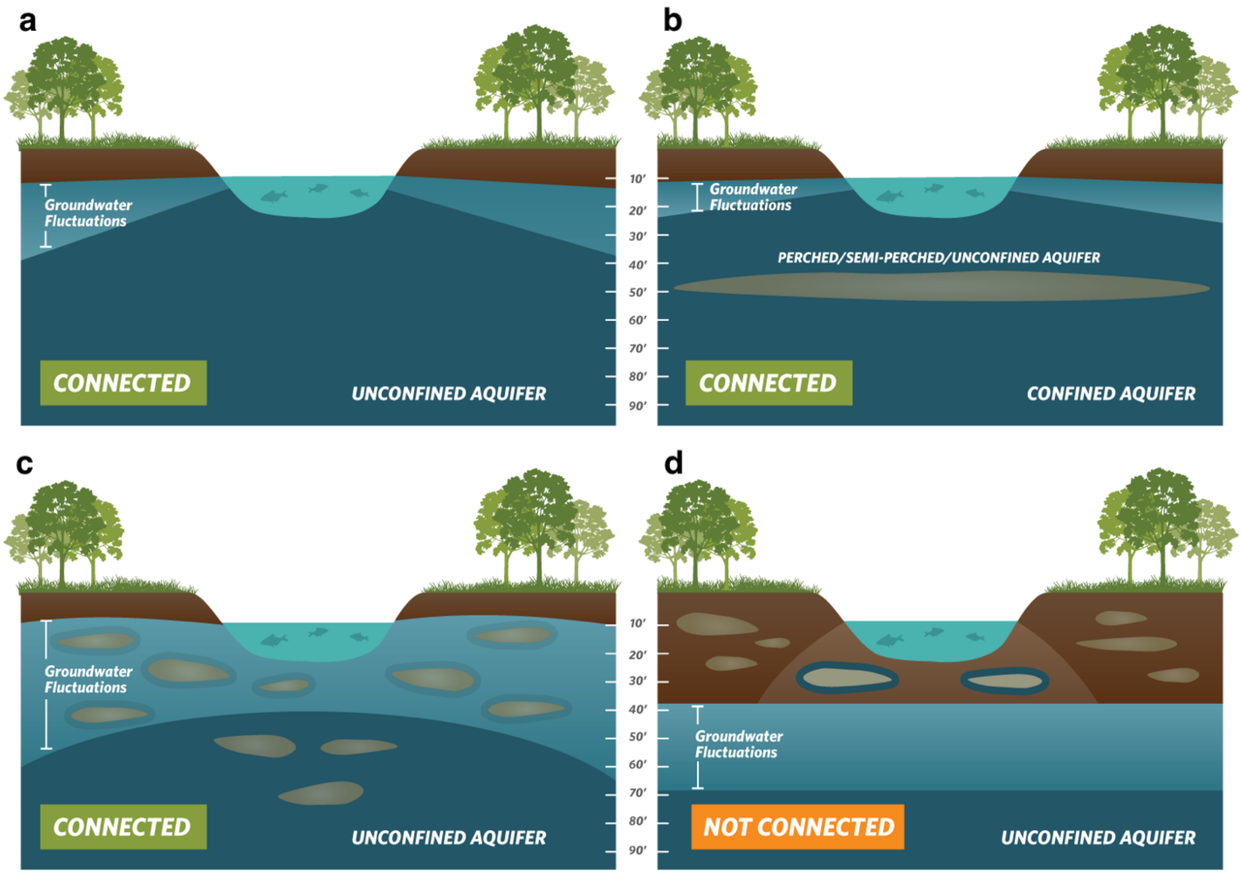

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

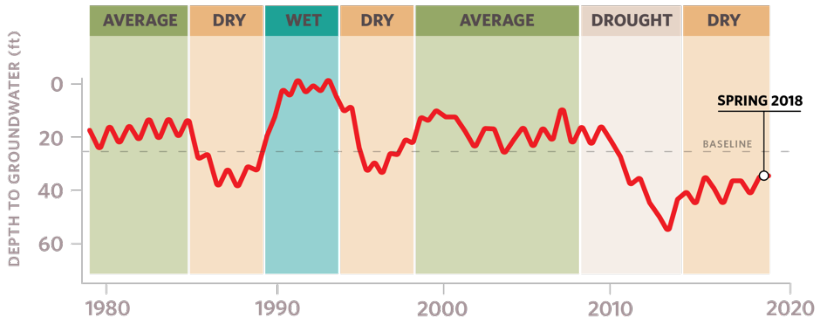

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

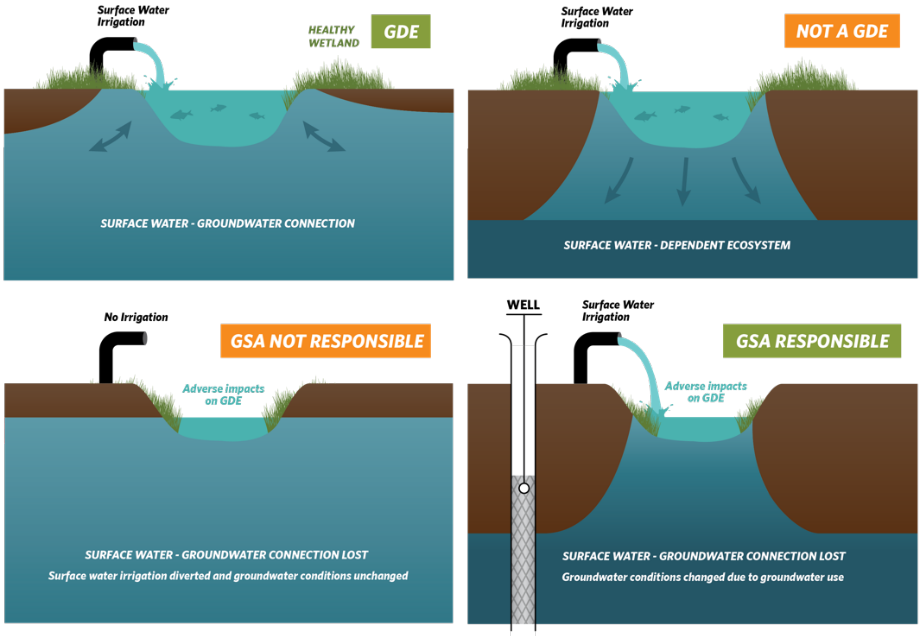

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

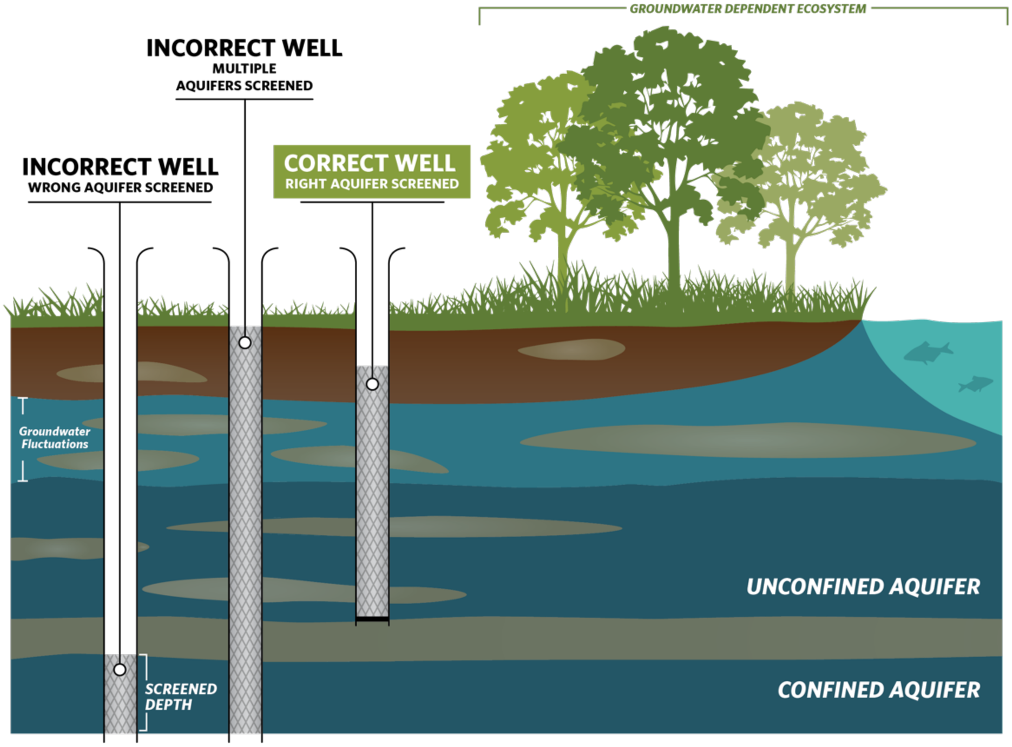

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

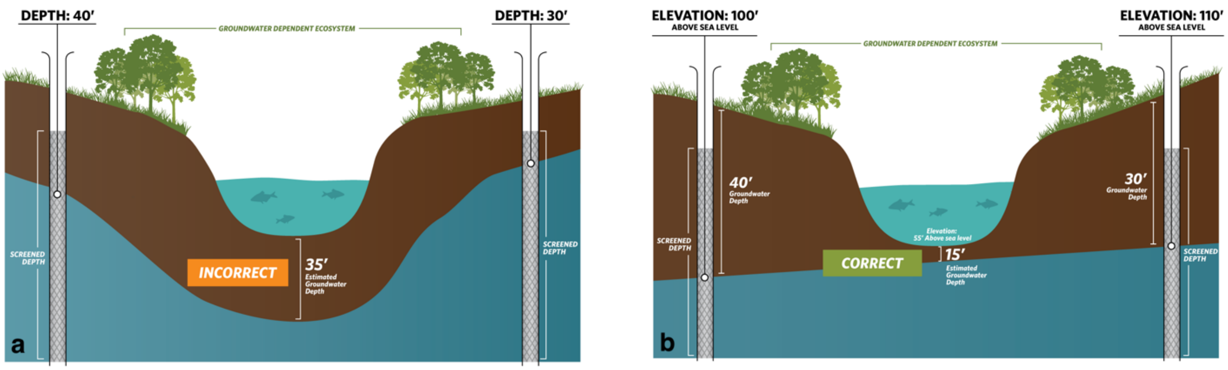

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

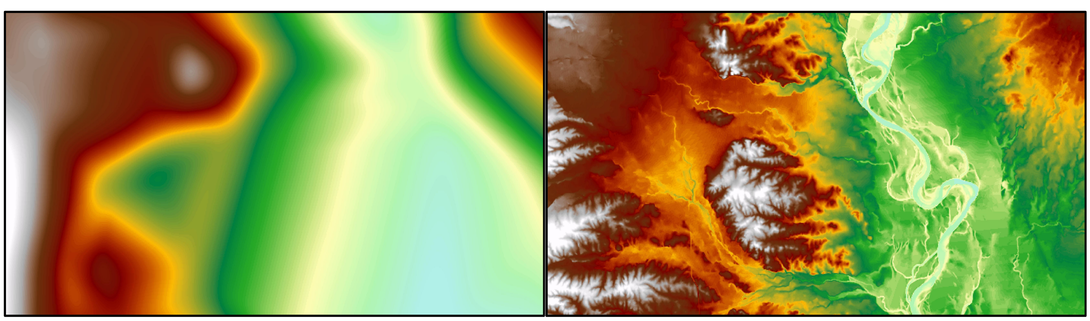

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

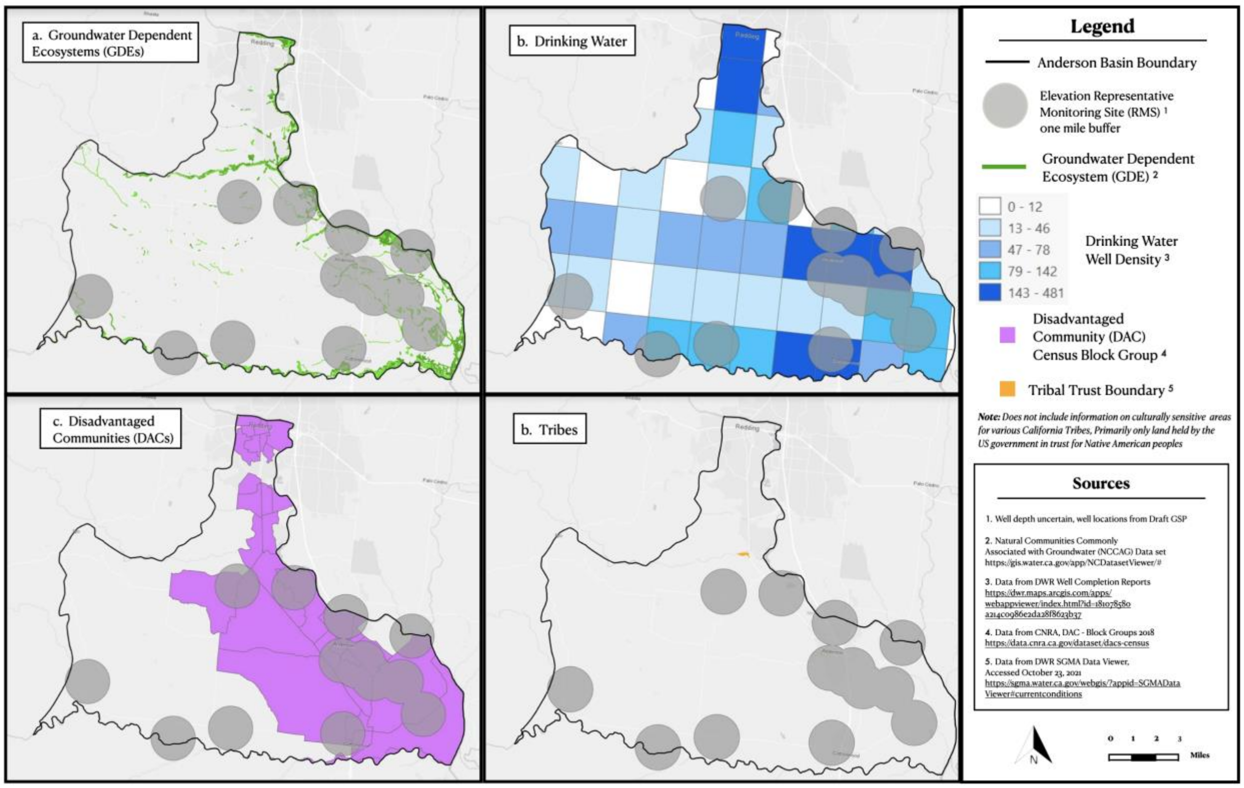

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

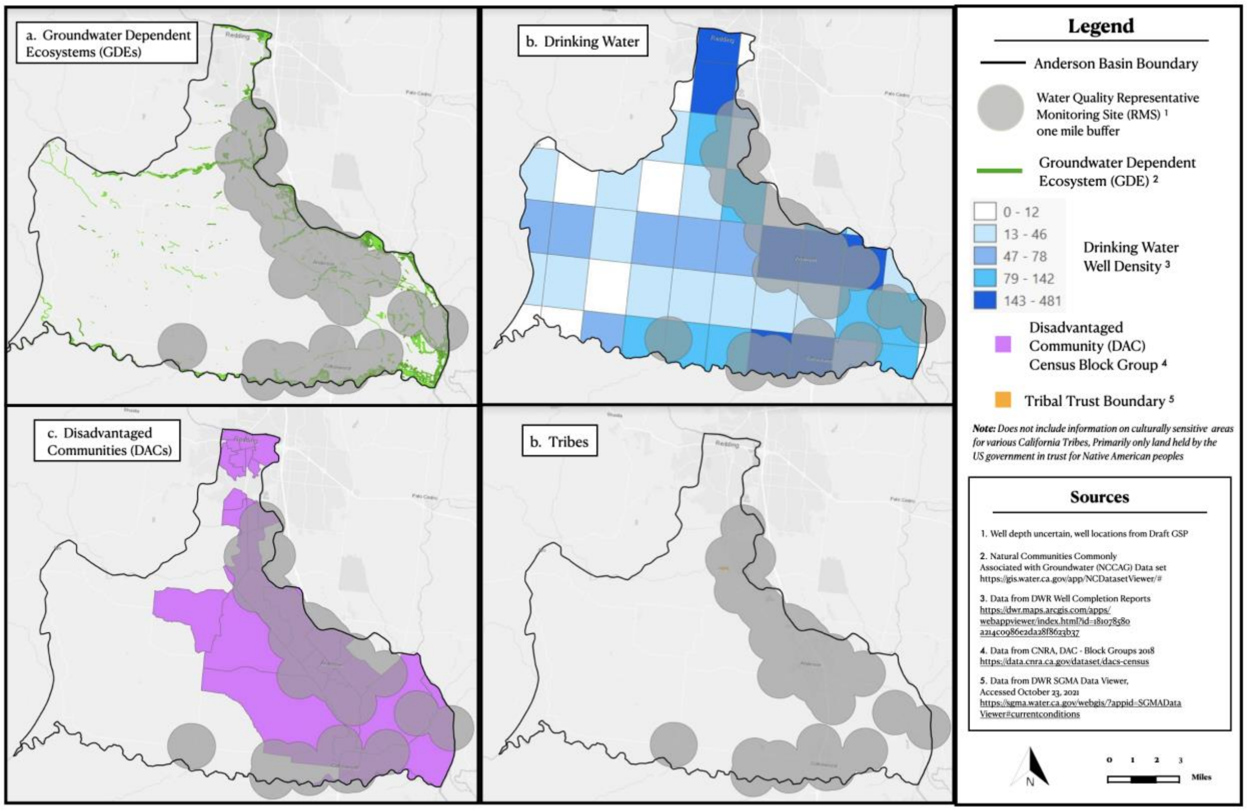

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

November 19, 2021

Tehama County Flood Control and Water Conservation District GSA
9380 San Benito Ave
Gerber, CA 96035

Submitted via email: nbethurem@tcpw.ca.gov

Re: Public Comment Letter for Antelope Subbasin Draft GSP

Dear Nichole Bethurem,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Antelope Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, tribes, drinking water users, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Antelope Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Antelope Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. We note the following deficiencies with the identification of these key beneficial users.

- The GSP erroneously maps "Economically Disadvantaged Areas" rather than "Disadvantaged Communities" in Figure 2-11. The GSP must map the locations of DACs within the subbasin, identify each DAC by name, and provide the population of each DAC. The GSP also fails to identify the population dependent on groundwater as their source of drinking water in the subbasin.

- The plan identifies the Greenville Rancheria Tribe as a stakeholder within the subbasin, but does not provide a map of the tribal lands or tribal interests in the subbasin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide a map that identifies each DAC in the subbasin by name and provide the population of each identified DAC. Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). • Provide a map of tribal lands and describe tribal interests in the subbasin.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

Interconnected Surface Waters
The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP describes the use of a groundwater model (Tehama Integrated Hydrologic Model) to analyze the interaction between groundwater and surface water within the subbasin. While Appendix 2-J gives a detailed description of the model, the GSP could be improved by including a summary in the main GSP text. This information should include groundwater level monitoring well data and stream gauge data that were incorporated into the model, the screening depths of wells used in the groundwater model, and description of the temporal (seasonal and interannual) variability of the data used to calibrate the model.

The GSP does not provide any concluding statements in the GSP text about which reaches are considered to be interconnected. Figure 2-52 (Surface Water and Shallow Groundwater Monitoring Stations) presents stream reaches in the subbasin labeled as perennial and intermittent/ephemeral. However, this figure does not label reaches as interconnected, disconnected, or reaches with data gaps.

RECOMMENDATIONS
• Provide a map showing all the stream reaches in the subbasin, with reaches clearly labeled as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP. • In the main text of the GSP, summarize the groundwater elevation data and stream flow data used in the modeling analysis. Discuss temporal (seasonal and interannual) variability of the data used to calibrate the model. • To confirm and illustrate the results of the groundwater modeling, overlay the subbasin's stream reaches with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis. • For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

Groundwater Dependent Ecosystems
The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). Potential GDEs were identified in areas overlying groundwater within 30 feet of land surface based on Spring 2015 groundwater conditions, but this was the only dataset used to characterize groundwater conditions in the subbasin's GDEs. We recommend using groundwater data from multiple seasons and water year types over the pre-SGMA period (i.e., 2005-2015) to determine the range of depth to groundwater. Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying GDEs and is necessary to capture the variability in groundwater conditions inherent in

California's Mediterranean climate. The GDE Appendix (Appendix 2-H) refers to Figure 1 through Figure 4 that illustrate the steps of the GDE analysis. These figures appear to be missing from the appendix, however.

The GSP does not provide an inventory of flora and fauna in the subbasin, nor is any discussion of threatened or endangered species provided.

RECOMMENDATIONS

- Include the missing Figures 1-4 in the GDE Appendix 2-H.
- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.
- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape.
- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as Valley Oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether Valley Oak polygons from the NC Dataset are connected to groundwater. It is important to emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and proximity to other water sources.
- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.
- Provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin and note any threatened or endangered species (see Attachment C in this letter for a list of freshwater species located in the Antelope Subbasin).

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of native vegetation into the water budget is **sufficient**. We commend the GSA for including the groundwater demands of this ecosystem in the historical, current and projected water budgets. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the subbasin.

RECOMMENDATION
• State whether or not there are managed wetlands in the subbasin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Communications and Engagement Plan (Appendix 2-A).[4]

We note the following deficiencies with the overall stakeholder engagement process:

- The GSP identifies the Greenville Rancheria as tribal stakeholders present within the subbasin. Appendix C (of the Communications and Engagement Plan) describes Tribal Engagement in Tehama County. This appendix describes outreach principles, outreach partners, and steps to be taken for tribal engagement. However, the GSP does not state what steps were actually taken or the results of tribal engagement actions.

- The GSP documents opportunities for public involvement and engagement in general terms. Public outreach and engagement activities include public meetings, public hearings, workshops, public notices, stakeholder briefings, newsletters, and updates to the GSA website. While the GSP provides a guidance document on DAC engagement, its description consists primarily of informing DACs by outreach to DAC-related organizations. The GSP does not state whether DACs and environmental stakeholders are represented on a GSA Advisory Committee or Board.

- The plan does not include documentation on how stakeholder input from the above mentioned outreach and engagement was considered and incorporated into the GSP development process.

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[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- We note that Appendix G (of the Communications and Engagement Plan) is still under development and will include more details of outreach to stakeholders during GSP implementation. Ensure that as this section is finalized, it includes a detailed plan for continual opportunities for engagement through the implementation phase of the GSP that is specifically directed to DACs, domestic well owners, and environmental stakeholders.

RECOMMENDATIONS

- In the Communications and Engagement Plan, describe active and targeted outreach to engage all stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. While some of these resources have already been stated in the GSP, we recommend that the GSA should improve utilization of these resources and documentation of the engagement process.

- Provide documentation on how stakeholder input was incorporated into the GSP development process.

- Provide information on whether the GSA has initiated contact with tribal stakeholders in the subbasin during GSP development, and how tribal concerns were considered during the GSP development process.

- Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the subbasin.[5]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP states (p. 3-17): *"The MTs were set to the following: Upper Aquifer: Spring groundwater elevation where less than 10 - 20% (on average) of domestic wells could potentially be impacted."* No further details are provided on the minimum threshold impacts to domestic wells, including the methodology used to conduct the assessment. The GSP does not sufficiently describe whether minimum thresholds will avoid significant and

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[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, nor does it describe how the groundwater levels minimum thresholds are consistent with the Human Right to Water policy.[9]

The undesirable result for chronic lowering of groundwater levels is established as (p. 3-31): *"25% of groundwater elevations measured at the same RMS wells exceed the associated MTs for two (2) consecutive measurements. If the water year is dry or critically dry, then levels below the MTs are not undesirable if groundwater management allows for recovery in average or wetter years."* By only using minimum threshold exceedances during non-drought years to define undesirable results for groundwater levels, significant and unreasonable impacts to beneficial users experienced during dry years or periods of drought will not result in an undesirable result. This is problematic since the GSP is failing to manage the subbasin in such a way that strives to minimize significant adverse impacts to beneficial users, which are often felt greatest in below-average, dry, and drought years. Furthermore, the requirement that 25% of monitoring wells exceed the minimum threshold before triggering an undesirable result means that areas with high concentrations of domestic wells may experience impacts significantly greater than the established minimum threshold because the 25% threshold isn't triggered.

For degraded water quality, minimum thresholds are set for total dissolved solids (TDS) to 750 milligrams per liter (mg/L), lower than the upper secondary maximum contaminant level (SMCL) of 1,000 mg/L. This is the only constituent of concern (COC) for which SMC are established. Section 2.2.2.3 (Groundwater Quality) discusses other COCs (nitrate, arsenic, and boron) in the subbasin that have exceeded regulatory standards. Significantly, the narrative identifies nitrate levels in the northern portion of the subbasin as significant and increasing. Nitrate is an acute contaminant; failure to address or mitigate this impact will have a direct impact on public health, particularly for domestic well owners who may not be aware that their well is contaminated. SMC should be established for all COCs in the subbasin that may be impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs, domestic well owners, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels. Include information on the impacts during prolonged periods of below average water years.

- Consider minimum threshold exceedances during drought years when defining the groundwater level undesirable result across the subbasin.

Degraded Water Quality

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when defining undesirable results for degraded water quality.[10] For specific guidance on how

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

[10] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

to consider these users, refer to “Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act.”[11]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs, drinking water users, and tribes.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that are impacted or exacerbated by groundwater use and/or management.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC.

Sustainable management criteria for depletion of interconnected surface water are established by proxy using groundwater levels. The GSP states (p. 3-25): “*MTs are interim and will be the same water levels used in for the chronic lowering of groundwater elevations described in Section 3.3.1.1. Extensive data gaps are discussed in Section 3.7.8.7. The GSA will continue to evaluate new monitoring information and determine these thresholds later.”* While the GSP clearly recognizes the data gap for depletion of interconnected surface water SMC, we would like to see further discussion of how the interim SMC will affect beneficial users, and more specifically GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. The GSP makes no attempt to evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when ‘significant and unreasonable’ effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the

[11] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

subbasin.[12] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[13]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[14] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,15]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[16] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[17] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios provided by DWR into projected water budgets or selecting more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have

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12 "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

13 The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

14 "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

15 Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

16 "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

17 Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP integrates climate change into key inputs (e.g., changes in precipitation, evapotranspiration, and surface water flow) of the projected water budget, and calculates a sustainable yield based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of extreme climate scenarios, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, tribes, and domestic well owners.

RECOMMENDATIONS
• Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions. • Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, GDEs, and ISWs in the subbasin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[18]

Figure 3-1 (Representative Monitoring Sites) shows insufficient representation of DACs and drinking water users for water quality monitoring. Figure 3-2 (Groundwater Level Representative Monitoring Sites – Upper Aquifer) and Figure 3-3 (Groundwater Level Representative Monitoring Sites – Lower Aquifer) show insufficient representation of DACs and drinking water users for groundwater elevation monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater.

The GSP provides some discussion of data gaps for GDEs in Section 3.7.8.7 (Assessment and Improvement of Monitoring Network - Interconnected Surface Waters), but does not provide specific plans, such as locations or a timeline, to fill the data gaps. Figure 3-7 (Identification of Data Gaps (GDE)) maps high priority GDEs alongside existing shallow monitoring wells, but this figure does not show additional proposed monitoring well locations.

[18] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify monitored areas.
- Increase the number of RMSs in the shallow aquifer across the subbasin as needed to map ISWs and adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMSs.
- Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.
- Further describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin. Additional studies of GDEs and groundwater - surface water interactions are briefly discussed in the Projects and Management Actions chapter, but very few details are provided.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **incomplete**. The GSP identifies the benefits and impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs and DACs. However, projects and management actions to improve water supply and GDE habitats (e.g., Invasive Plant Removal from Creeks and Irrigation Conveyance Canals, Levee Setback and Stream Channel Restoration) are described as potential projects without a known timeline for implementation.

We commend the GSA for describing the environmental benefits of the Multi-Benefit Recharge Project (Section 4.3.3) in the subbasin, as developed with support and guidelines from The Nature Conservancy.

The GSP describes the Tehama County Domestic Well Tracking and Outreach Program (Section 4.5.2.6) and the Well Deepening or Replacement Program (Section 4.5.2.7). However, these programs are described as potential projects to be implemented on an as-needed basis, instead of projects that will be implemented within the GSP planning horizon. We strongly recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation.

RECOMMENDATIONS

- Describe the projected timelines for implementing the Invasive Plant Removal and Levee Setback and Stream Channel Restoration projects and management actions in Chapter 4 of the GSP.
- For DACs and domestic well owners, provide specific plans for implementation of a drinking water well impact mitigation program to proactively monitor and protect

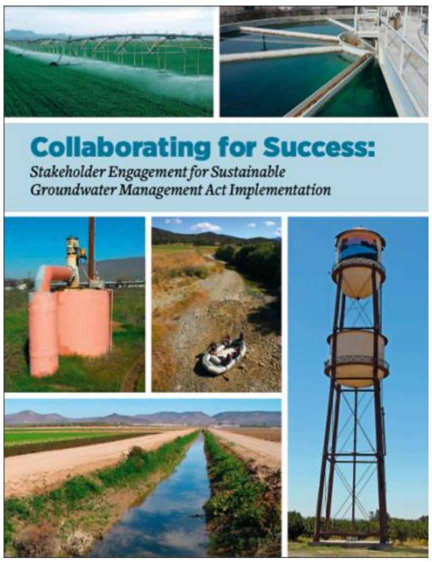
drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



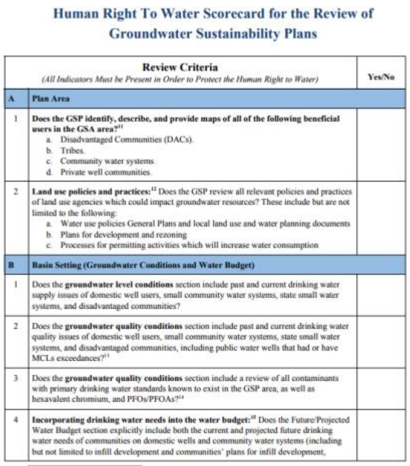
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

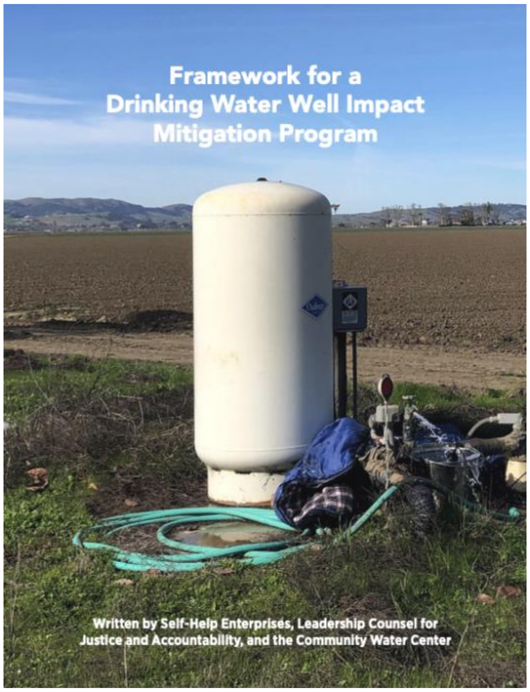
The Human Right to Water


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria (*All Indicators Must be Present in Order to Protect the Human Right to Water*)	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

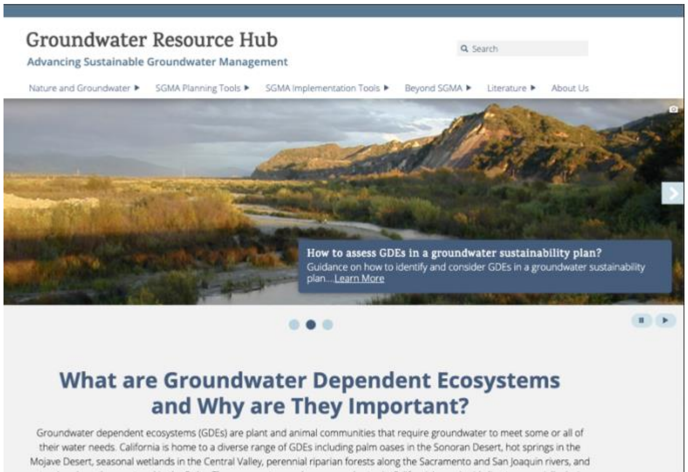
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



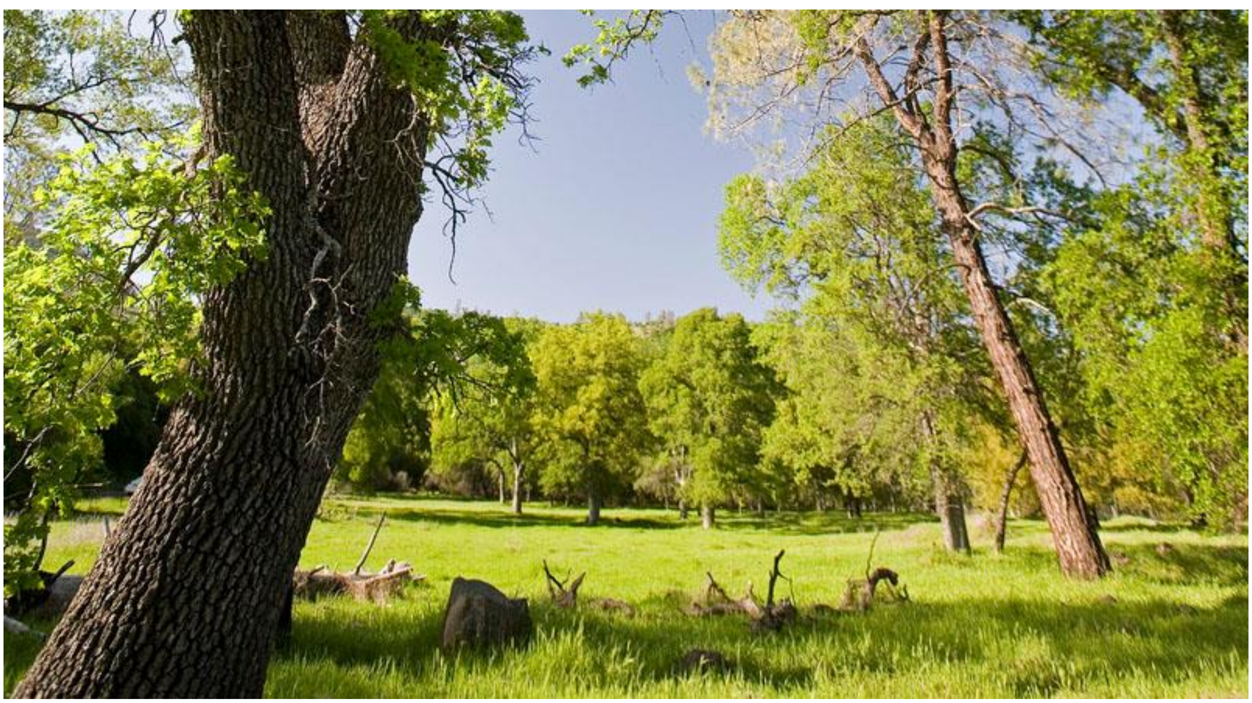
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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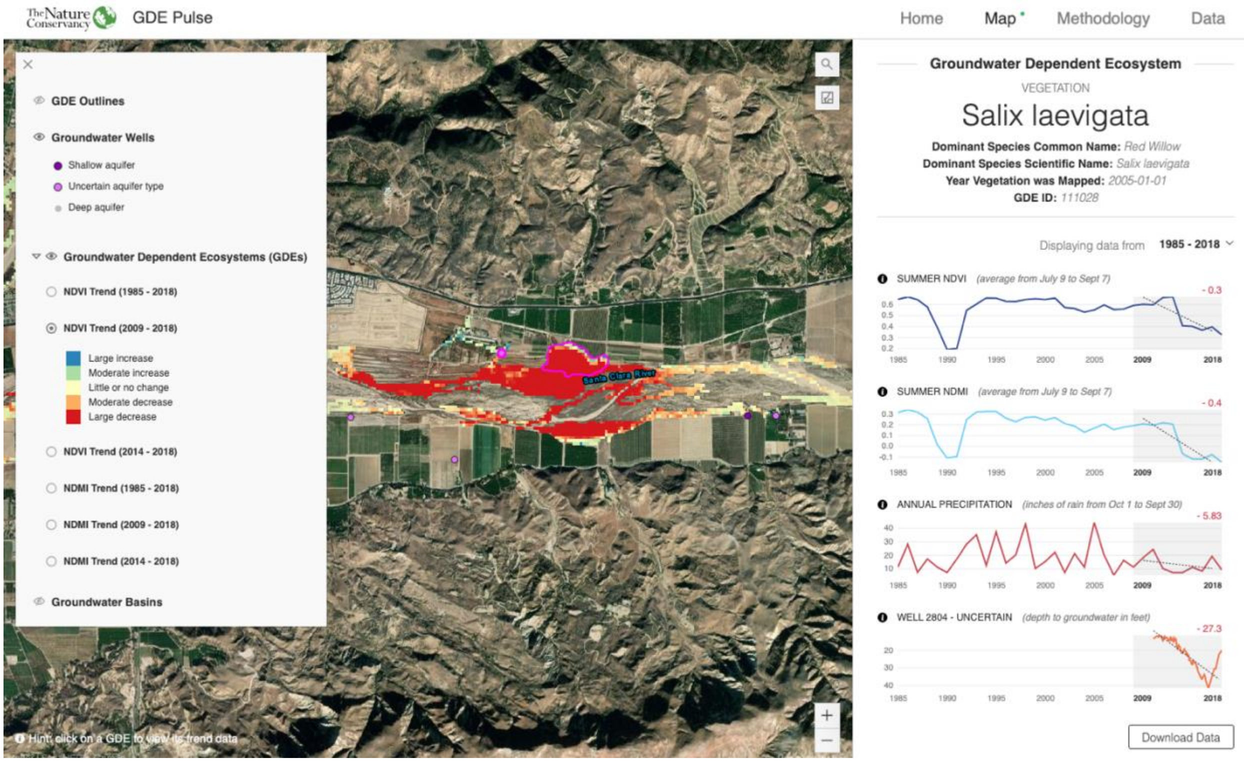
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](https://gde.codefornature.org/) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

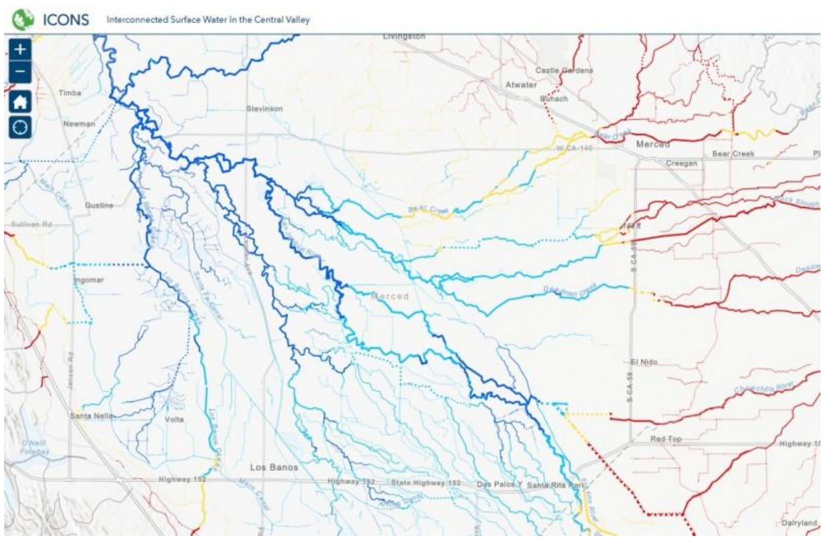
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Antelope Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Antelope Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	**State**	**Other**
BIRDS				
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endang ered	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cygnus buccinator	Trumpeter Swan			
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Dendrocygna bicolor	Fulvous Whistling-Duck		Special Concern	BSSC - First priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endang ered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			

Gallinula chloropus	Common Moorhen			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endang ered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oreothlypis luciae	Lucy's Warbler		Special Concern	BSSC - Third priority
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threate ned	

Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta gigas	Giant Fairy Shrimp			
FISH				
Catostomus santaanae	Santa Ana sucker	Threatened	Special Concern	Endangered - Moyle 2013
Gasterosteus aculeatus williamsoni	Unarmored threespine stickleback	Endangered	Endangered	Endangered - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern	ARSSC
Anaxyrus punctatus	Red-spotted Toad			
Pseudacris cadaverina	California Treefrog			ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Rana muscosa	Southern Mountain Yellow-legged Frog	Endangered	Candidate Endangered	ARSSC
Spea intermontana	Great Basin Spadefoot			ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC

Thamnophis sirtalis sirtalis	Common Gartersnake			
Anaxyrus boreas halophilus	California Toad			ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
Rana aurora	Northern Red-legged Frog		Special Concern	ARSSC
INSECTS & OTHER INVERTS				
Capnia valhalla	Viking Snowfly			
Acentrella spp.	Acentrella spp.			
Agabus disintegratus				Not on any status lists
Ameletus spp.	Ameletus spp.			
Anax junius	Common Green Darner			
Argia vivida	Vivid Dancer			
Atherix pachypus				Not on any status lists
Attenella soquele	A Mayfly			
Baetis flavistriga	A Mayfly			
Baetis tricaudatus	A Mayfly			
Berosus infuscatus				Not on any status lists
Brachycentrus americanus	A Caddisfly			
Brachycentrus echo	A Caddisfly			
Chironomidae fam.	Chironomidae fam.			
Chloroperlidae fam.	Chloroperlidae fam.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Cricotopus nostocicola				Not on any status lists
Dicosmoecus spp.	Dicosmoecus spp.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Drunella coloradensis	A Mayfly			

Drunella spp.	Drunella spp.			
Enallagma carunculatum	Tule Bluet			
Epeorus spp.	Epeorus spp.			
Eukiefferiella spp.	Eukiefferiella spp.			
Glossosoma spp.	Glossosoma spp.			
Heterocerus mexicanus				Not on any status lists
Heteroplectron californicum	A Caddisfly			
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila spp.	Hydroptila spp.			
Ischnura denticollis	Black-fronted Forktail			
Libellula saturata	Flame Skimmer			
Limnephilidae fam.	Limnephilidae fam.			
Limnephilus spp.	Limnephilus spp.			
Micrasema spp.	Micrasema spp.			
Narpus spp.	Narpus spp.			
Neophylax spp.	Neophylax spp.			
Optioservus spp.	Optioservus spp.			
Pachydiplax longipennis	Blue Dasher			
Paracladopelma spp.	Paracladopelma spp.			
Paraleptophlebia spp.	Paraleptophlebia spp.			
Perlidae fam.	Perlidae fam.			
Perlinodes aurea	Longgill Springfly			
Polypedilum spp.	Polypedilum spp.			
Rhantus gutticollis				Not on any status lists
Rhionaeschna multicolor	Blue-eyed Darner			
Rhyacophila arnaudi	A Caddisfly			
Rhyacophila spp.	Rhyacophila spp.			
Serratella spp.	Serratella spp.			
Simulium spp.	Simulium spp.			

Skwala spp.	Skwala spp.			
Sperchon spp.	Sperchon spp.			
Sympetrum corruptum	Variegated Meadowhawk			
Zaitzevia parvula				Not on any status lists
Zaitzevia spp.	Zaitzevia spp.			
Bisancora rutriformis	Scooped Sallfly			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
Sorex palustris	American Water Shrew			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Planorbella traski	Keeled Rams-horn			X
Planorbella trivolvis	Marsh Rams-horn			CS
PLANTS				
Puccinellia simplex	Little Alkali Grass			
Alnus rhombifolia	White Alder			
Alopecurus aequalis aequalis	Short-awn Foxtail			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			

Baccharis glutinosa	NA			Not on any status lists
Baccharis salicina				Not on any status lists
Beckmannia syzigachne	American Sloughgrass			
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Carex alma	Sturdy Sedge			
Carex schottii	Schott's Sedge			
Castilleja miniata miniata	Greater Red Indian-paintbrush			
Chloropyron maritimum canescens				Not on any status lists
Datisca glomerata	Durango Root			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis parishii	Parish's Spikerush			
Euthamia occidentalis	Western Fragrant Goldenrod			
Helenium puberulum	Rosilla			
Hosackia oblongifolia	NA			1.B.3
Juncus dubius	Mariposa Rush			
Juncus duranii	Duran's Rush		Special	CRPR - 4.3
Juncus macrophyllus	Longleaf Rush			
Juncus mertensianus	Mertens' Rush			
Juncus nodosus	NA		Special	CRPR - 2B.3

Juncus rugulosus	Wrinkled Rush			
Juncus textilis	Basket Rush			
Juncus xiphioides	Iris-leaf Rush			
Lemna minor	Lesser Duckweed			
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus guttatus	Common Large Monkeyflower			
Mimulus parishii	Parish's Monkeyflower			
Mimulus pilosus				Not on any status lists
Muhlenbergia utilis	Aparejo Grass			
Navarretia fossalis	Spreading Navarretia	Threatened	Special	CRPR - 1B.1
Perideridia pringlei	Pringle's Yampah		Special	CRPR - 4.3
Persicaria amphibia				Not on any status lists
Persicaria hydropiperoides				Not on any status lists
Phacelia distans	NA			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Platanus racemosa	California Sycamore			
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton pusillus pusillus	Slender Pondweed			
Ranunculus hydrocharoides	NA		Special	CRPR - 2B.1
Rumex salicifolius salicifolius	Willow Dock			

Ruppia maritima	Ditch-grass			
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Schoenoplectus acutus acutus	NA			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus americanus	Three-square Bulrush			
Schoenoplectus californicus	California Bulrush			
Scirpus microcarpus	Small-fruit Bulrush			
Solidago spectabilis	Nevada Goldenrod			
Stachys albens	White-stem Hedge-nettle			
Stuckenia pectinata				Not on any status lists
Symphyotrichum frondosum	Alkali Aster			
Toxicoscordion venenosum venenosum				Not on any status lists
Triglochin maritima	Common Bog Arrow-grass			
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	NA			

Zannichellia palustris	Horned Pondweed			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

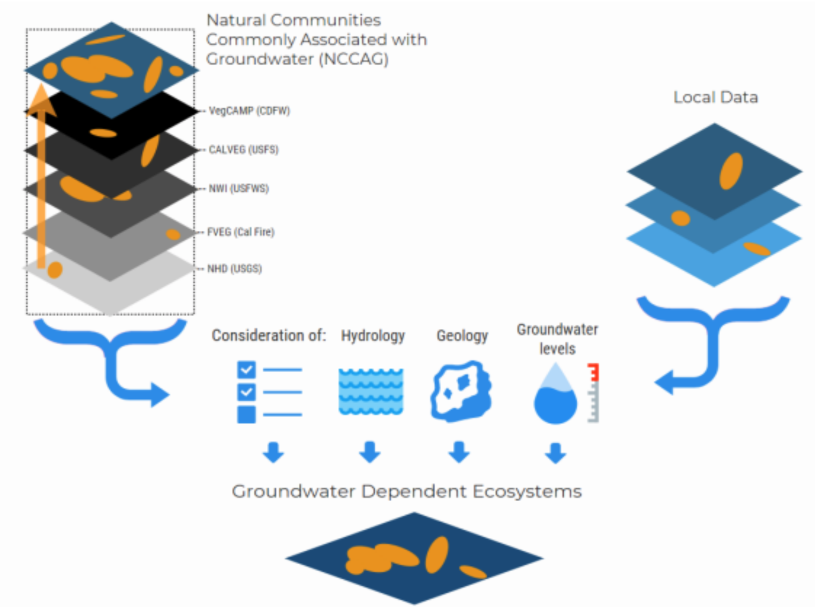


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

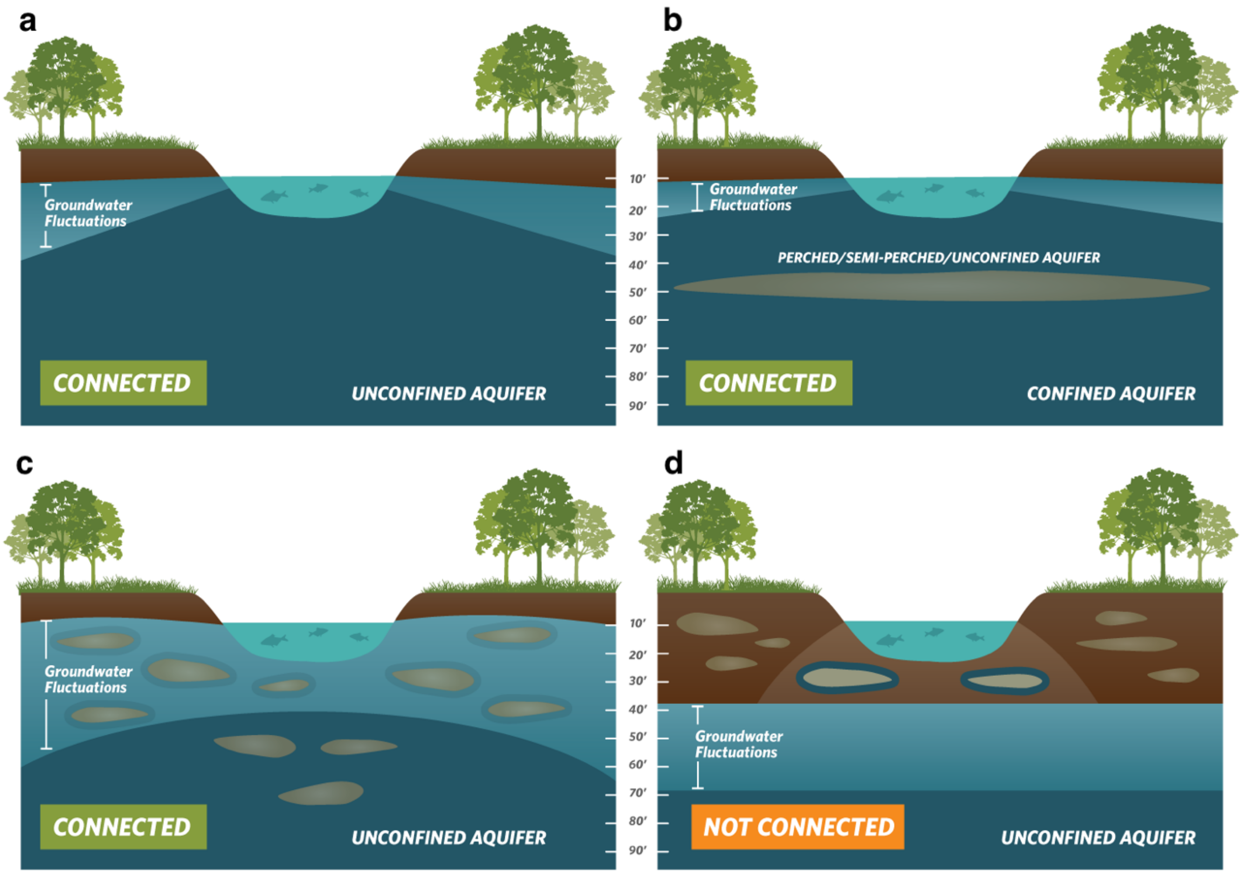

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

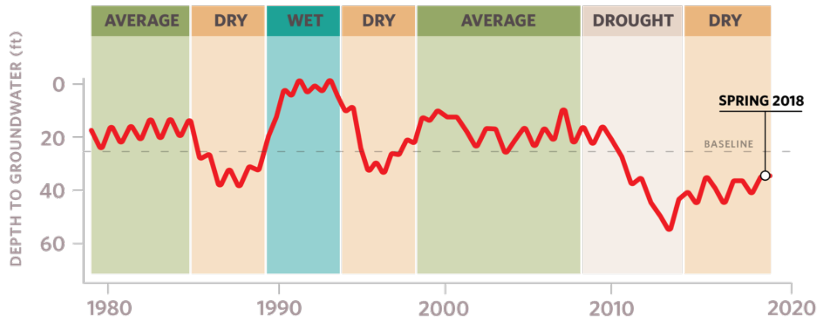

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

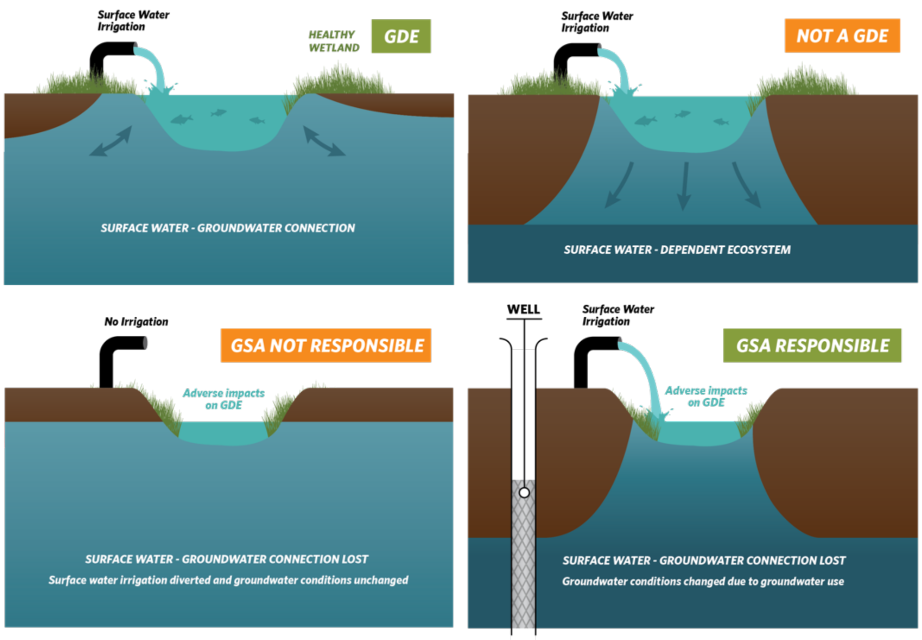

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

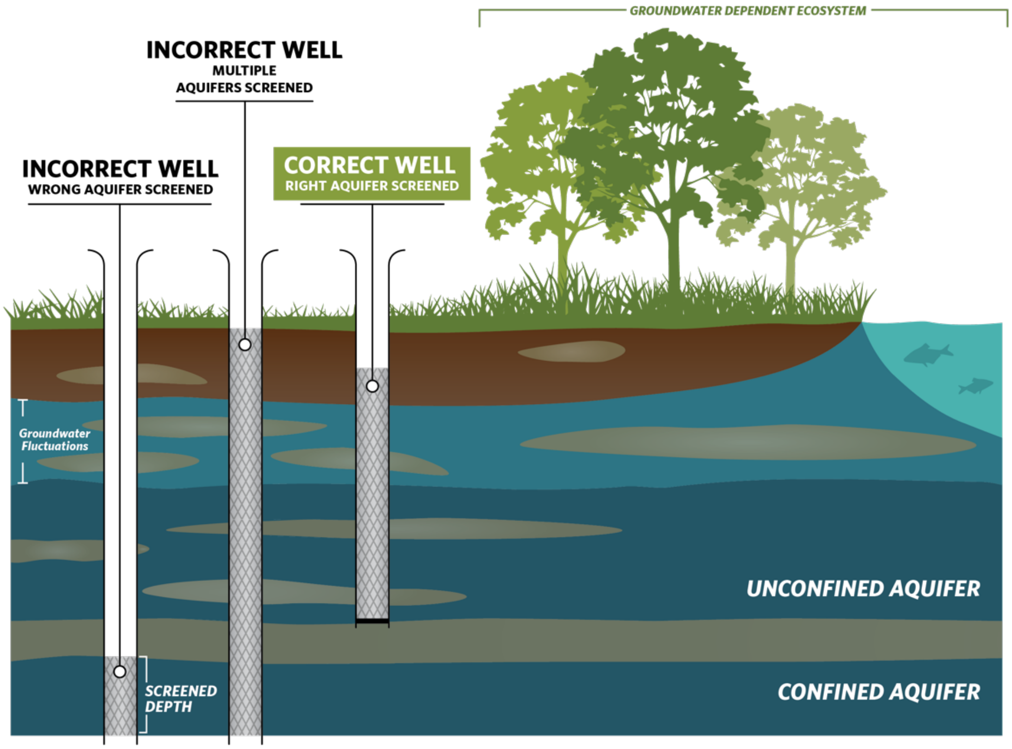

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

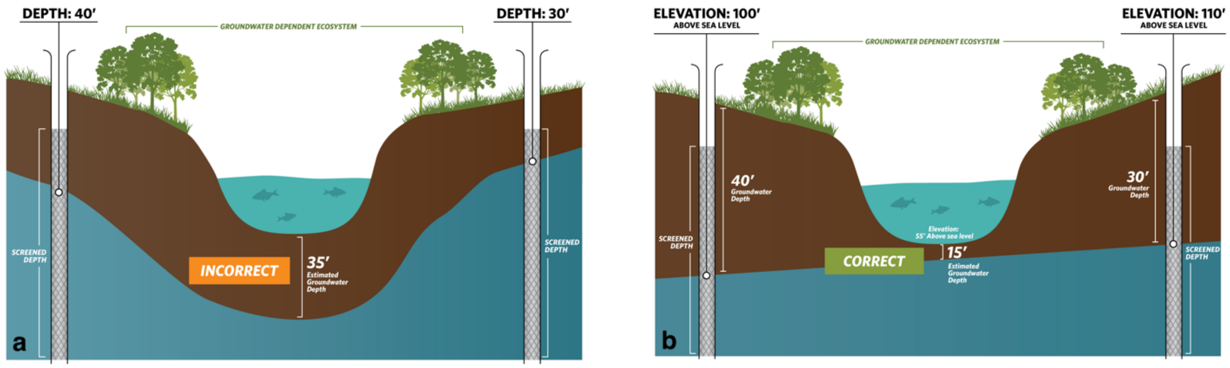

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

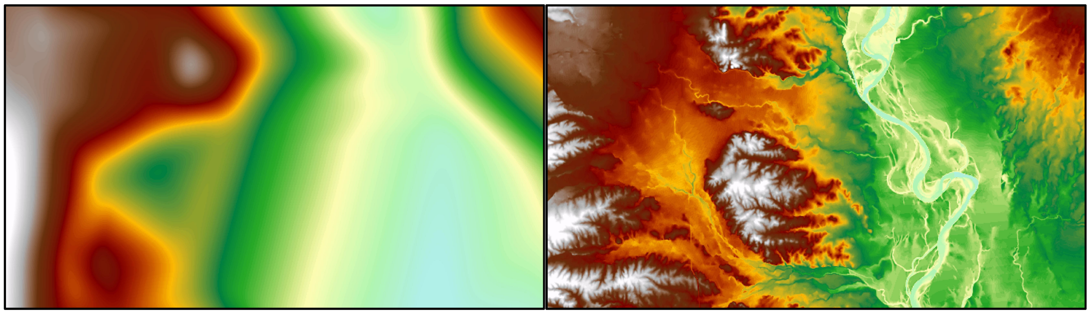

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

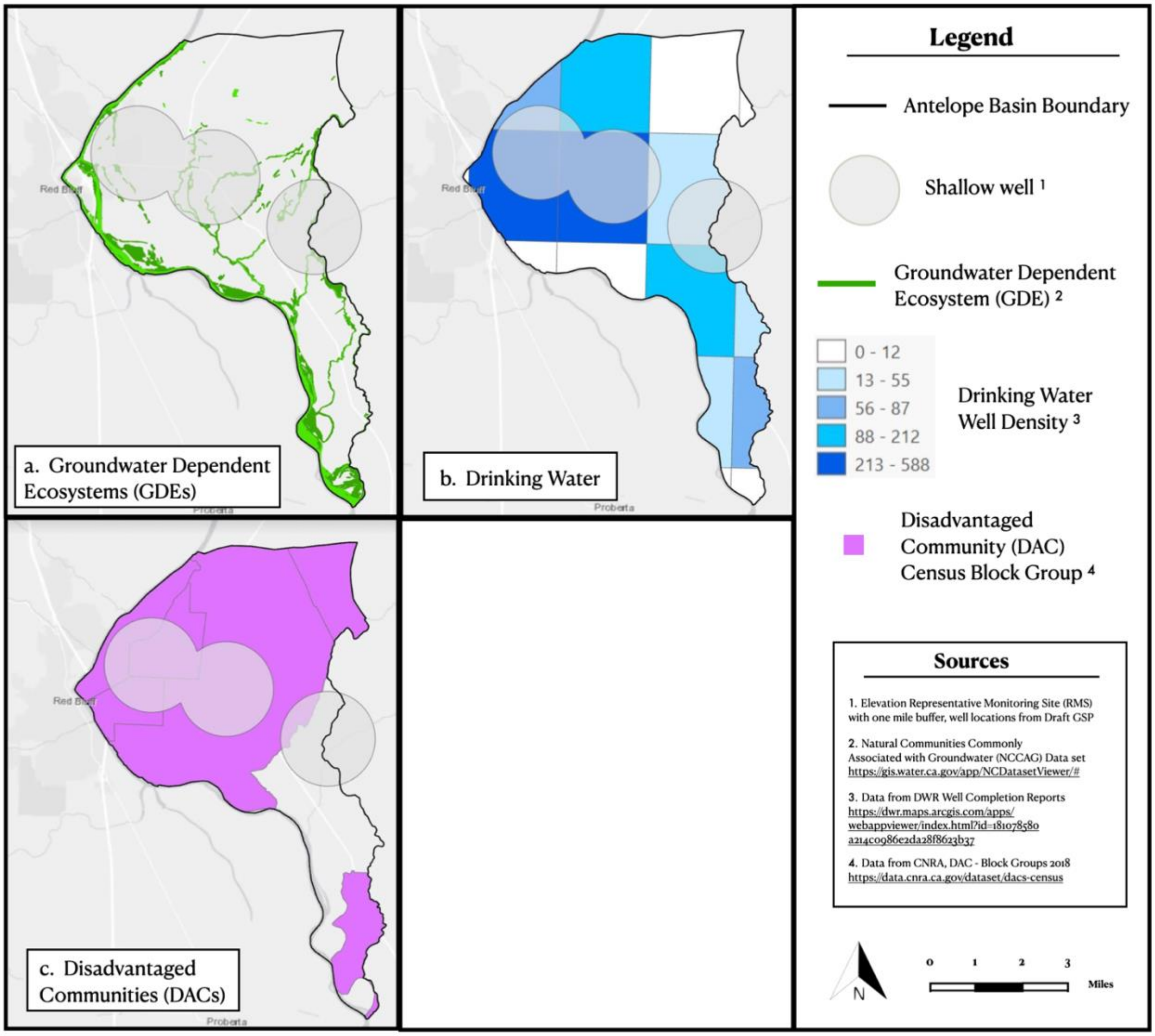

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

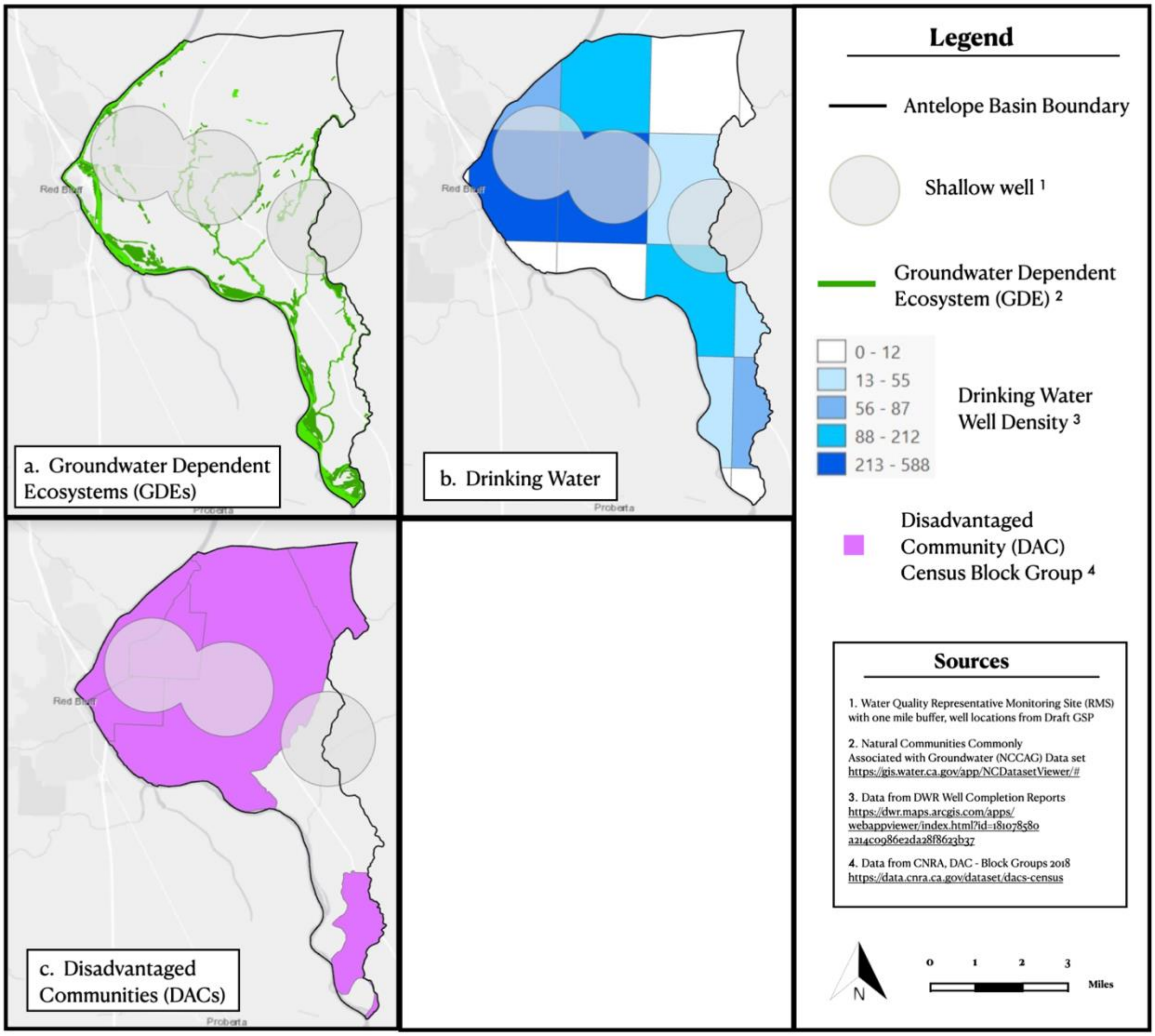

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

September 6, 2021

Bedford Coldwater Groundwater Sustainability Authority
c/o Temescal Valley Water District
22646 Temescal Valley Road
Temescal Valley, CA 92883

Submitted via email: victor@hhwaterresources.com

Re: Public Comment Letter for the Bedford-Coldwater Basin Draft GSP

Dear Victor Harris,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Bedford-Coldwater Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Draft Bedford-Coldwater Basin GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Bedford-Coldwater Basin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**, due to lack of clarity around tribal lands in the basin. The GSP states that there are no tribal lands in the basin, but includes four tribes in the list of stakeholders presented in Appendix D, Table 1.

The GSP indicates that there are no DACs in the basin (Section 2.1.2). The GSP includes a map of the density of domestic wells in the basin (Figure 2-4). The GSP should be further improved by including a map of individual domestic well locations and by indicating the population dependent on groundwater for their source of drinking water.

The missing elements regarding tribes and domestic wells are required for the GSA to fully understand the specific interests and water demands of these beneficial users, to support the development of water budgets using the best available information, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS
• Describe the occurrence of tribal lands in the basin. If tribes have interests in the basin, describe them in detail. • Include a map of individual domestic well locations and a table of well data showing screen depths. Indicate the population dependent on groundwater for their source of drinking water.

Interconnected Surface Waters

The identification of Interconnected Surface Water (ISW) is **insufficient**.

The GSP describes the use of aerial photos to analyze stream reaches during the dry season. However, this analysis is insufficient to determine interconnected reaches. The GSP states: "the reach of Temescal Wash that passes through the Bedford-Coldwater Basin does not appear to gain flow from groundwater seepage into the channel, at least during the dry season. Water levels in wells near the creek further suggest that the water table is usually below the creek bed elevation." Both of these sentences appear to discount the time periods when the stream reaches *may* be interconnected. The regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

Therefore, potential ISWs are not being identified, described, nor managed in the GSP. Until a disconnection can be proven, include all potential ISWs in the GSP. This is necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water.

RECOMMENDATIONS
● Provide a map showing all the stream reaches in the basin, with reaches clearly labeled. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP. ● Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. ● Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. ● Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of comprehensive, systematic analysis of the basin's GDEs.

The GSP uses TNC's GDE Pulse Tool to describe trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI), and provided a map of change in NDMI (Figure 4-16) plotted on NC dataset polygons. Additionally, the GSP provides general discussion of riparian vegetation and depth to groundwater. However, the depth to groundwater data was not directly used to verify the NC dataset polygons.

In particular, we found that some mapped features in the NC dataset were improperly disregarded based on the following:

- GDEs were disregarded based on the presence or proximity of surface water. However, partial reliance on surface water does not necessarily prove that the plants and animals do not access groundwater. Many GDEs often simultaneously rely on multiple sources of water (i.e., both groundwater and surface water), or shift their reliance on different sources on an interannual or inter-seasonal basis. Additionally, adverse impacts can occur to GDEs due to pumping that further separates groundwater from surface water.

- Mapped features in the NC dataset were disregarded if Normalized Difference Vegetation Index (NDVI) and Normalized Difference Moisture Index (NDMI) data downloaded from GDE Pulse did not correlate with groundwater. This is an incorrect method, since a lack of a relationship does not preclude that groundwater is providing some of the ecosystem's water needs. If the ecosystem is tapping into shallow groundwater then the ecosystem should be categorized as a GDE. If there are no data to characterize groundwater conditions in the shallow principal aquifer, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP.

RECOMMENDATIONS

- Develop and describe a systematic approach for analyzing the basin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained or removed from the NC dataset (and the removal reason if polygons are not considered potential GDEs). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Use depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- Please provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the basin and note any threatened or endangered species (see Attachment C in this letter for a list of freshwater species located in the Bedford-Coldwater basin). The GSP provides a habitat map of the federally listed bird species gnatcatcher, but this is the only species referenced under the GDE discussion. The GSP mentions the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP), but provides few details.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included into the water budget. The integration of native vegetation into the water budget is **sufficient**. We commend the GSA for including the groundwater demands of this ecosystem in the historical, current and projected water budgets. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATION
• State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the Stakeholder Outreach Plan included in the GSP (Appendix D). We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms. They include attendance at public meetings, stakeholder email list, and updates to the GSP website.
- Domestic well owners are specifically mentioned in the Stakeholder Engagement Plan as holders of overlying groundwater rights, however no information is provided other than stating that their participation is invited in the GSP development process.
- The Stakeholder Outreach Plan does not include a plan for continual opportunities for engagement through the implementation phase of the GSP for tribes and environmental stakeholders.

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[1] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[2] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[3] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

RECOMMENDATIONS

- Include a more detailed and robust Stakeholder Outreach Plan that describes active and targeted outreach to engage domestic well owners, environmental stakeholders, and tribal stakeholders during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Describe the occurrence of tribal lands in the basin. The GSP states that there are no tribal lands in the basin, but includes four tribes in the list of stakeholders presented in Table 1. If tribes have interests in the basin, describe them in detail.

- Describe efforts to consult and engage with tribes within the basin. Refer to the DWR guidance entitled *Engagement with Tribal Governments* for specifics on how to consult with tribes.[4]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[5] and establishing minimum thresholds.[6,7]

Disadvantaged Communities and Drinking Water Users

The GSP has aligned the minimum thresholds for contaminants of concern to maximum contaminant levels (MCLs), but has done so by averaging monitored concentrations over a 5-year period and over the entire basin. The TDS water quality minimum threshold basin-wide is defined as 5-year average concentrations not exceeding the 1,000 mg/L Secondary MCL for TDS. The nitrate water quality minimum threshold basin-wide is defined as 5-year average concentrations not exceeding the 10 mg/L drinking water MCL for nitrate as nitrogen. The monitored concentrations are totaled from each well and then divided by the total number of wells to achieve a single value representing average conditions over the entire Basin.

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[4] DWR Guidance Document for Engagement with Tribal Governments https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[5] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[6] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[7] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

The GSP acknowledges that the method of averaging concentrations (p. 6-25) "is slightly different than the suggested methods to determine sustainability, [but] the GSA desired a single quantitative value to guide management." Despite this explanation, we still disagree with averaging monitored concentrations over time and space. This is not an adequate methodology since concentrations averaged over 5-years and over the entire basin can not detect impacts to beneficial users of groundwater.

The GSP discounts domestic wells in the setting of SMC, based on the rationale that there are very few private wells in the basin, known private wells are for non-potable use, and responsibility for potential undesirable results to shallow wells is shared between a GSA and a well owner. Therefore, potential impacts on all beneficial users of groundwater in the basin have not been considered when defining undesirable results and establishing minimum thresholds.

RECOMMENDATIONS
Chronic Lowering of Groundwater Levels ● Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users within the basin. Further describe the impact of passing the minimum threshold for drinking water users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold. **Degraded Water Quality** ● Set minimum thresholds for degraded water quality that are compared to individually monitored concentrations, not those that are averaged over time or space. ● Describe direct and indirect impacts on drinking water users when defining undesirable results for degraded water quality. For specific guidance on how to consider domestic water users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[8] ● Evaluate the cumulative or indirect impacts of proposed minimum thresholds for TDS and nitrate on drinking water users. ● Provide distinct maps for PFOS, PFOA and sulfate contamination plumes as required in SGMA regulations[9].

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP uses 2014-2016 groundwater elevations as minimum thresholds for the depletion of interconnected surface water SMC (using groundwater elevations as proxy). We are concerned that this will not avoid undesirable results to environmental beneficial users. The true impacts to ecosystems under this scenario are not fully discussed in the GSP. If minimum thresholds are set to historic low groundwater levels and the subbasin is allowed to operate just above or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some

[8] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.
[9] "Groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes." [23 CCR §354.16(d)]

drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse.

The GSP states (p. 6-37) that “undesirable results did occur in the Bedford-Coldwater Basin during the recent drought, because vegetation die-back occurred along about 3.9 miles of the channel, or about 57 percent of the total length of Temescal Wash in the Basin.” The basin’s ecosystems could be further damaged or even destroyed if groundwater conditions are maintained just above those levels in the long-term, since the subbasin would be permitted to sustain extreme dry conditions over multiple seasons and years.

RECOMMENDATIONS

- Define chronic lowering of groundwater SMC directly for environmental beneficial users of groundwater. GDEs are discussed only in relation to the depletions of interconnected surface water SMC (using groundwater elevations as proxy for depletions of interconnected surface waters), but not directly for the chronic lowering of groundwater SMC.

- When defining undesirable results for chronic lowering of groundwater levels and depletions of interconnected surface waters, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when ‘significant and unreasonable’ effects on beneficial users are caused by groundwater conditions in the subbasin. Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[10] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[11] can be determined.

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[12] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2070. However, the GSP did not consider the 2070 extremely wet and extremely dry climate scenarios in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios

[10] “The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results”. [23 CCR §354.26(b)(3)]
[11] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.” [23 CCR §354.28(b)(4)]
[12] “Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow.” [23 CCR §354.18(e)]

for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

We acknowledge and commend the inclusion of climate change into key inputs (precipitation, evaporation, and surface water flow) of the projected water budget. Additionally, the sustainable yield is calculated based on the projected pumping for future projections that include climate change. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems and domestic well owners.

RECOMMENDATIONS

- Integrate extreme wet and dry scenarios into the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**. Without adequate monitoring and identification of data gaps, beneficial users of groundwater including GDEs, surface water users, and drinking water users will remain unprotected by the GSP. The Plan therefore fails to meet SGMA's requirements for the monitoring network[13]. We recommend the following steps to ensure that the monitoring network is protective of all beneficial users of groundwater.

RECOMMENDATIONS

- Provide maps that overlay monitoring well locations with the locations of GDEs and domestic wells to clearly identify potentially impacted areas. Ensure that existing and proposed representative monitoring sites adequately cover portions of the basin with GDEs and domestic wells.
- Provide a detailed plan for the investigation of shallow groundwater/surface water interaction at Temescal Wash as discussed in Section 8.6, instead of leaving this for a future project. Reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs.

[13] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

- Determine what ecological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin. The GSP mentions biological surveys in Section 8.6, but no details are given.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to lack of identification of benefits or impacts of identified projects and management actions to key beneficial users of groundwater such as GDEs, surface water users, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for all beneficial users.

RECOMMENDATIONS

Because GDEs, aquatic habitats, surface water users, and drinking water users were not sufficiently identified in the GSP, please consider including the following related to potential project and management actions in the GSP:

- Recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP refer to the “Multi-Benefit Recharge Project Methodology Guidance Document”[14].

- For domestic well owners, include discussion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

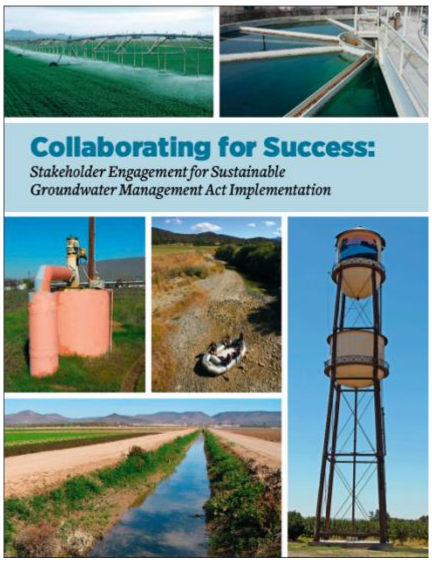
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[14] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

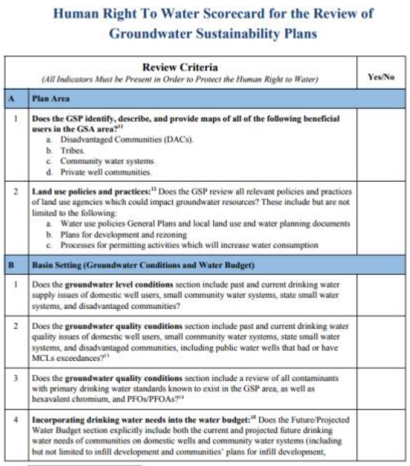
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

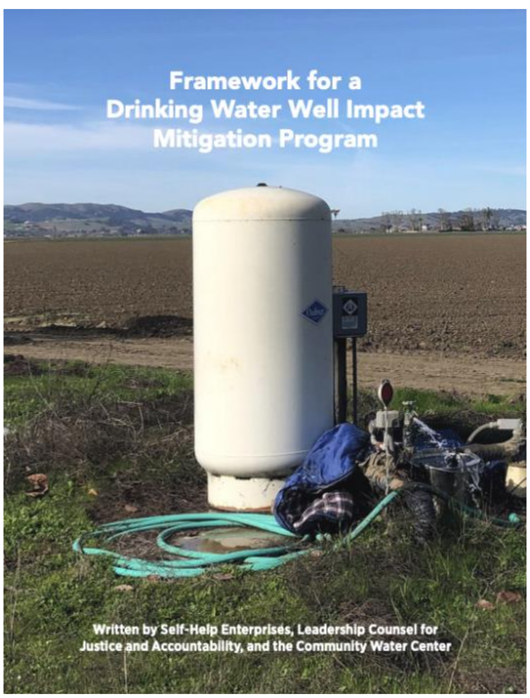
The Human Right to Water


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

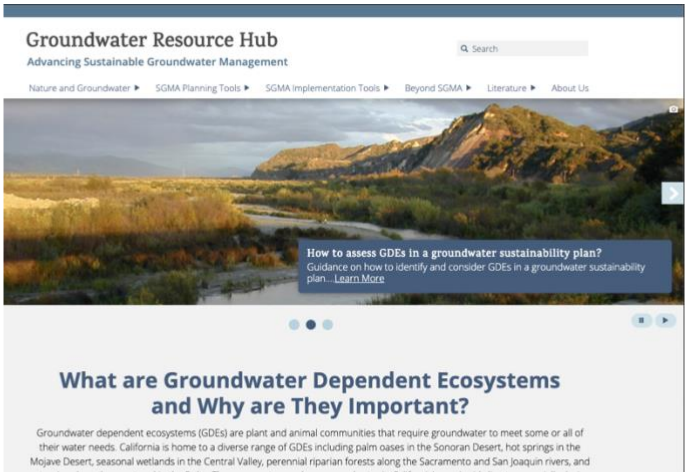
The [Human Right to Water Scorecard](#) was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



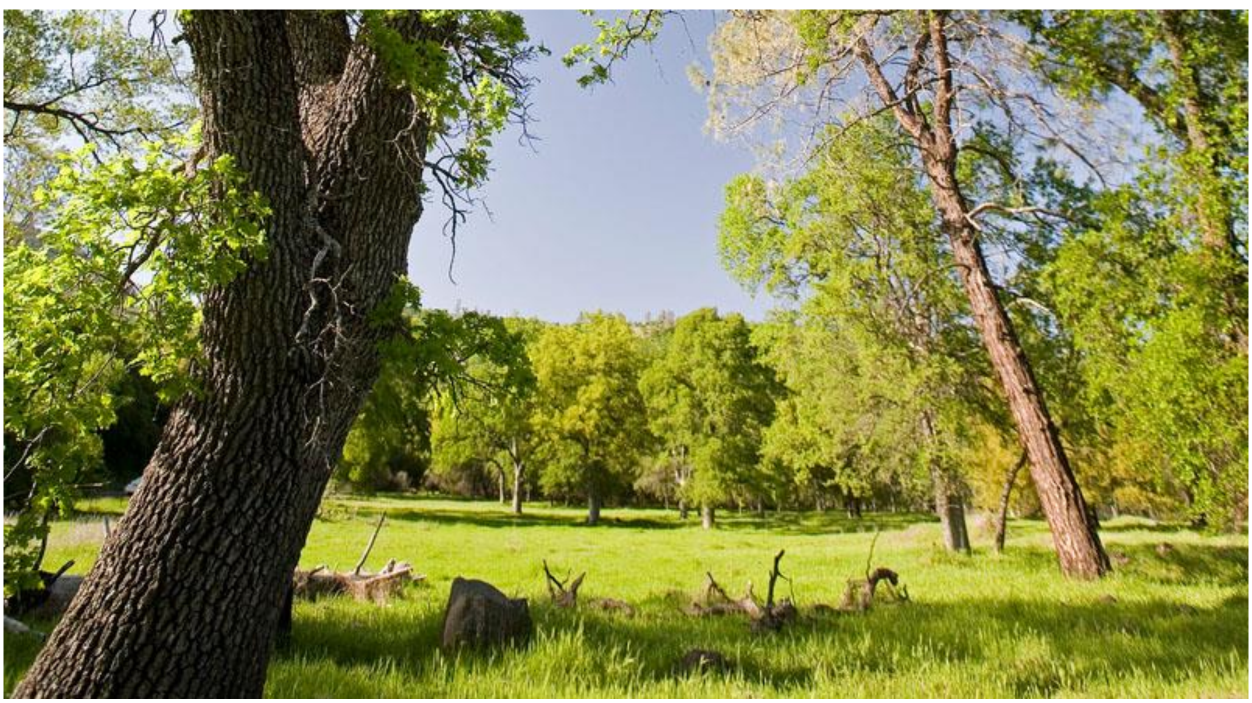
The [Drinking Water Well Impact Mitigation Framework](#) was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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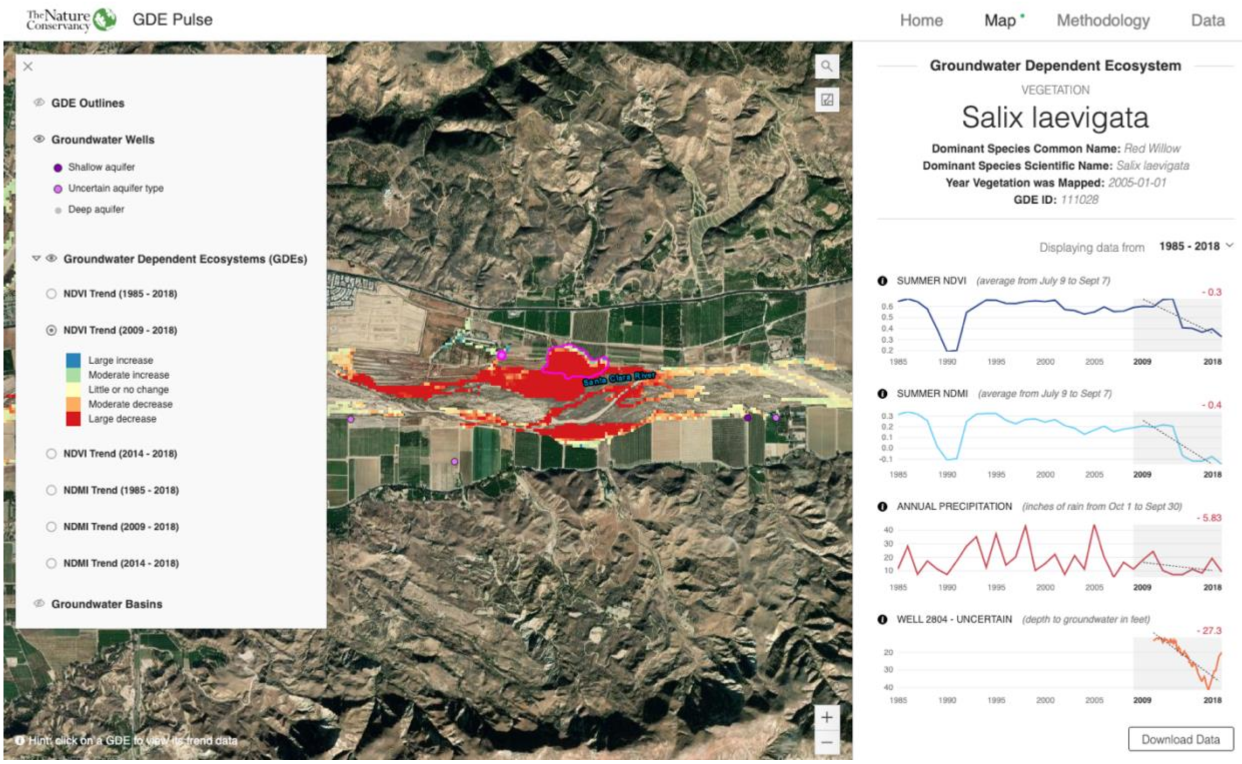
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

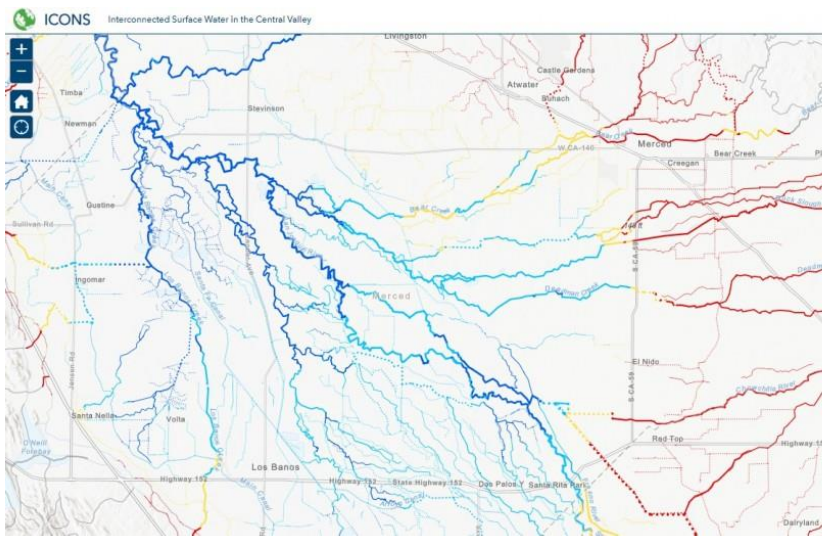
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Bedford-Coldwater Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Bedford-Coldwater Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Anas platyrhynchos	Mallard			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Butorides virescens	Green Heron			
Egretta thula	Snowy Egret			
Himantopus mexicanus	Black-necked Stilt			
Megaceryle alcyon	Belted Kingfisher			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Podilymbus podiceps	Pied-billed Grebe			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
CRUSTACEANS				
Crangonyx spp.	Crangonyx spp.			
Hyalella spp.	Hyalella spp.			
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern	ARSSC
Pseudacris cadaverina	California Treefrog			ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Alotanypus spp.	Alotanypus spp.			
Argia spp.	Argia spp.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Coenagrionidae fam.	Coenagrionidae fam.			
Cricotopus bicinctus				Not on any status lists
Cricotopus trifascia				Not on any status lists
Dicrotendipes spp.	Dicrotendipes spp.			
Eukiefferiella spp.	Eukiefferiella spp.			
Hetaerina spp.	Hetaerina spp.			
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Labrundinia spp.	Labrundinia spp.			
Libellulidae fam.	Libellulidae fam.			
Limnophyes spp.	Limnophyes spp.			
Micrasema spp.	Micrasema spp.			
Microtendipes spp.	Microtendipes spp.			
Nectopsyche spp.	Nectopsyche spp.			
Ochrotrichia spp.	Ochrotrichia spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Paratendipes spp.	Paratendipes spp.			
Pentaneura spp.	Pentaneura spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			

Procladius spp.	Procladius spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Tanytarsus spp.	Tanytarsus spp.			
Thienemannimyia spp.	Thienemannimyia spp.			
Tinodes spp.	Tinodes spp.			
Tipulidae fam.	Tipulidae fam.			
Tribelos spp.	Tribelos spp.			
Tricorythodes spp.	Tricorythodes spp.			
MOLLUSKS				
Ferrissia spp.	Ferrissia spp.			
Lymnaea spp.	Lymnaea spp.			
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			
Planorbidae fam.	Planorbidae fam.			
PLANTS				
Baccharis salicina				Not on any status lists
Cyperus erythrorhizos	Red-root Flatsedge			
Mimulus guttatus	Common Large Monkeyflower			
Mimulus pilosus				Not on any status lists
Phacelia distans	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Platanus racemosa	California Sycamore			
Pluchea odorata odorata	Scented Conyza			
Pluchea sericea	Arrow-weed			
Rorippa palustris palustris	Bog Yellowcress			
Rumex salicifolius salicifolius	Willow Dock			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Veronica anagallis-aquatica	NA			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

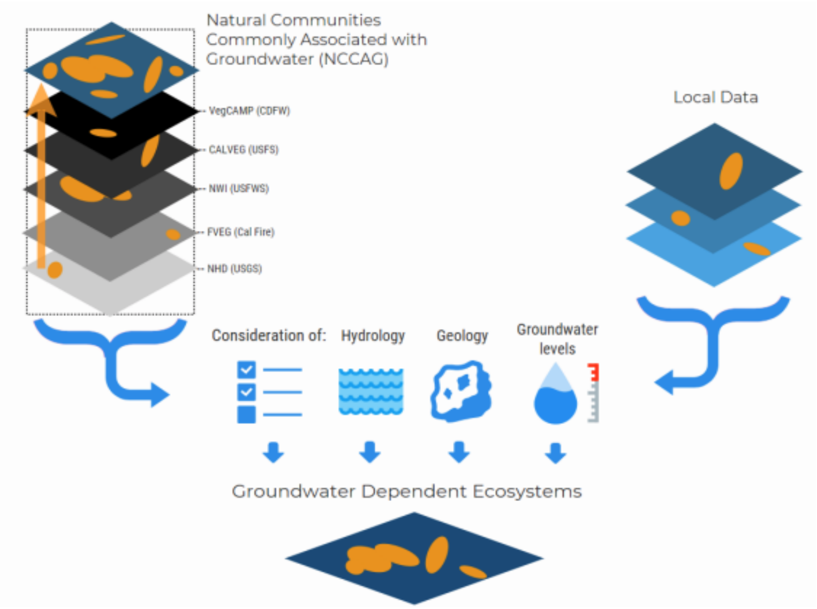


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

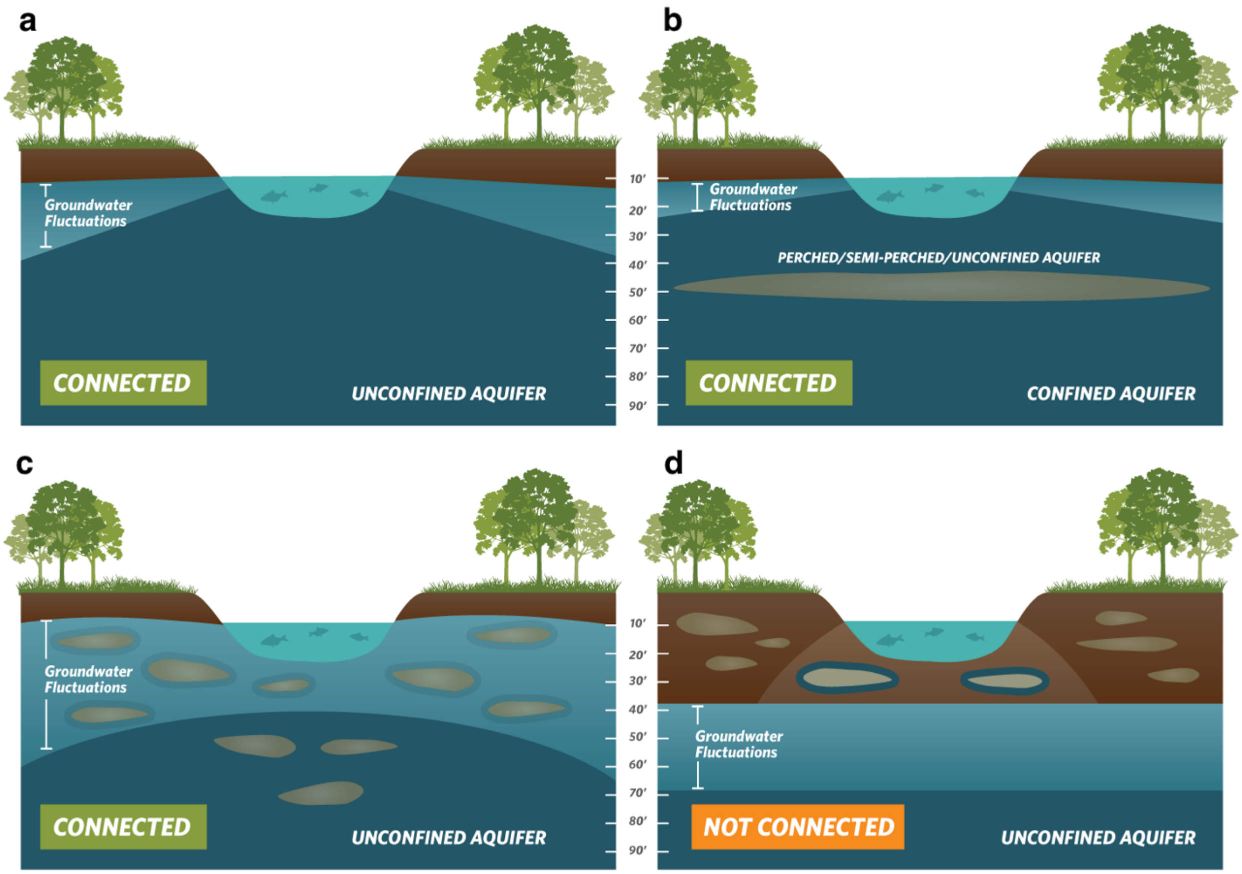

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

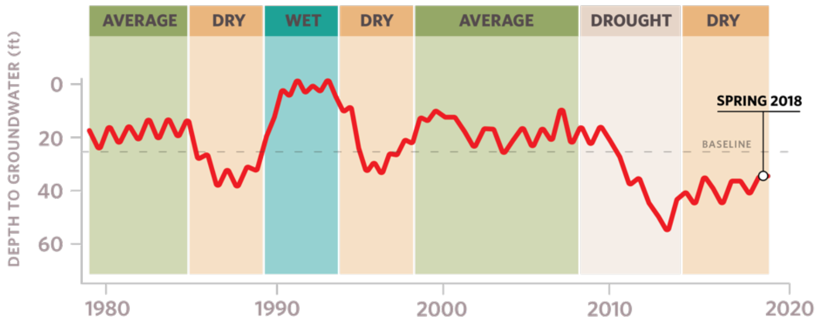

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

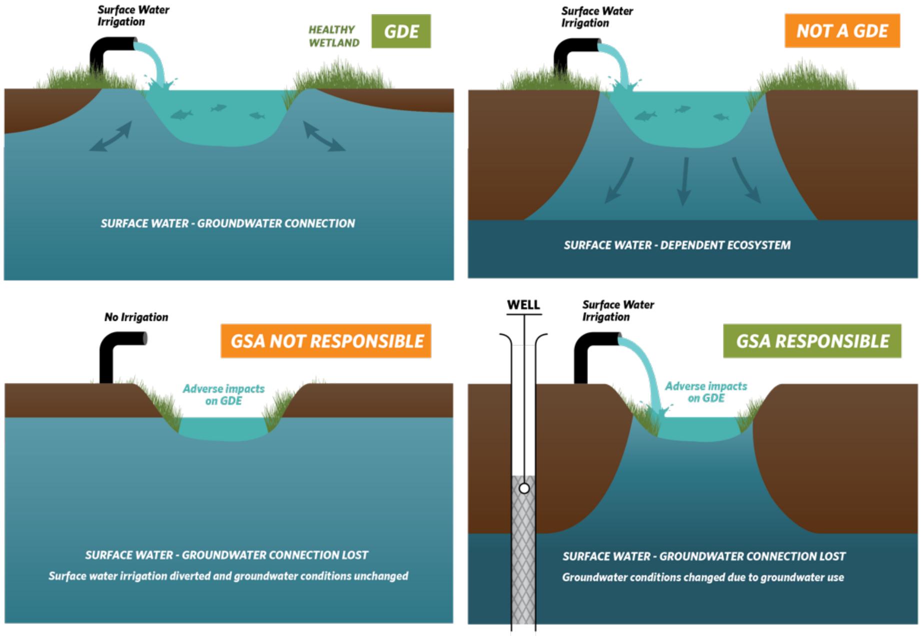

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

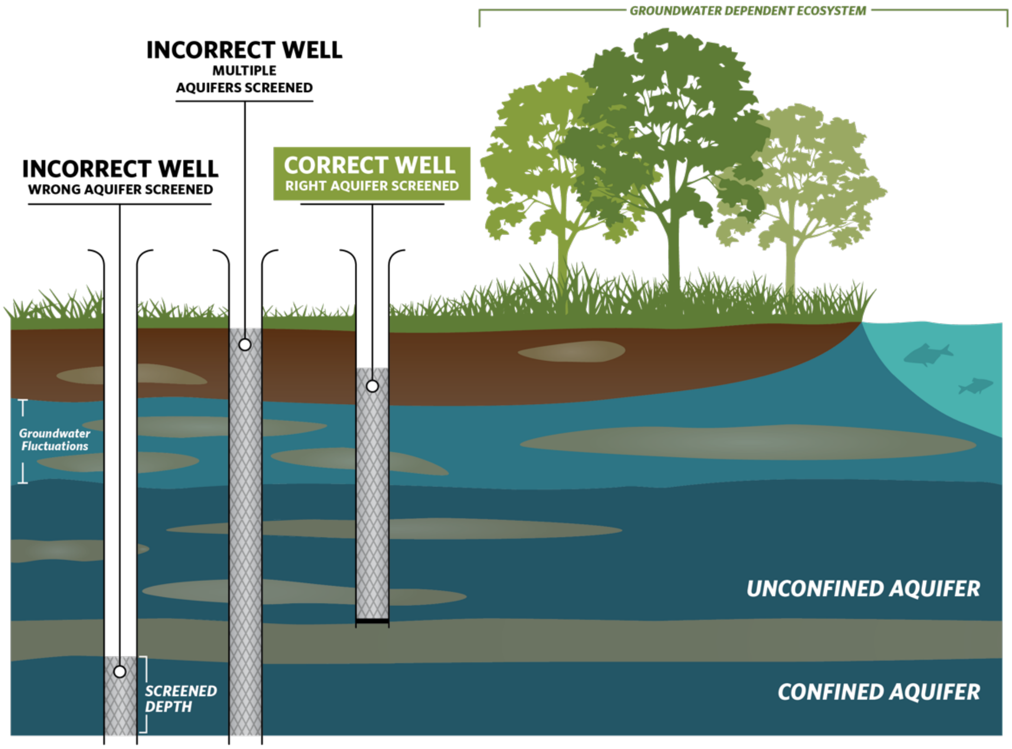

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

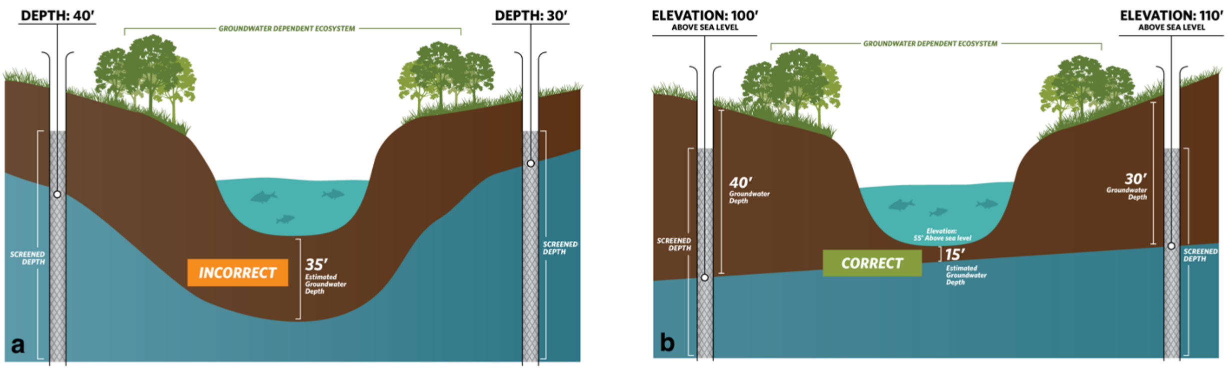

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

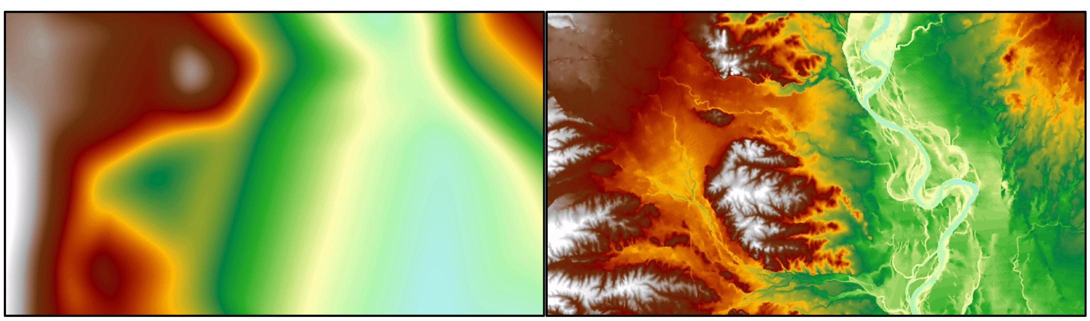

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

November 28, 2021

Lassen and Modoc County Groundwater Sustainability Agencies (GSAs)

Submitted via web:
https://bigvalleygsp.org/comment/new;jsessionid=5F3A0C5993B56E3B5F68A22E8CD4ECF3

Re: Public Comment Letter for Big Valley Draft GSP

Dear Tiffany Martinez,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Big Valley Groundwater Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Big Valley Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Big Valley Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. The GSP maps tribal areas on Figure 3-2 (Jurisdictional Areas), with Lookout Rancheria and Tribal Trust Land included on the map. However, we note the following deficiencies with the identification of these key beneficial users.

- While the plan identifies Modoc County and Lassen County as DACs, it fails to provide a map identifying the locations of each DAC by census block groups, tracts, or places. The plan also fails to clearly state the population of each DAC or include the population dependent on groundwater as their source of drinking water in the basin.

- The GSP provides a density map of domestic wells in the basin (Figure 3-7). However, the plan fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range). This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the basin.

These missing elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide a map of the locations of DACs within the basin and provide the population of each identified DAC. Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). • Include a map showing domestic well locations and average well depth across the basin.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

Interconnected Surface Waters
The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. To assess ISWs, the GSP assumes streams to be interconnected where the depth to water is less than 15 feet below ground surface, based on spring 2015 contours. However, it is common practice to utilize deeper thresholds, such as 50 feet below groundwater surface, to indicate a disconnected stream reach[2,3]. Furthermore, using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs. Using depth-to-groundwater contours from one point in time is not sufficient evidence to state that reaches are not connected to groundwater. In California's Mediterranean climate, groundwater interconnections with surface water can vary seasonally and interannually, and that natural variability needs to be considered when identifying ISWs.

RECOMMENDATIONS

- Use a deeper screening depth, such as 50 feet, to determine which stream reaches in the basin are potentially interconnected with groundwater.

- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.

- Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

- On the map of stream reaches in the basin (Figure 5-18), consider any segments with data gaps as potential ISWs and clearly mark them as such. Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems
The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, insufficient groundwater data was used to characterize groundwater conditions in the basin's GDEs. The GSP uses depth-to-groundwater data from fall 2015 to characterize areas where the depth to groundwater was less than 15 feet to identify potential GDEs. We recommend using groundwater data from multiple seasons and water year types to determine the range of depth to groundwater around NC dataset polygons. Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying GDEs and is necessary to capture the variability in groundwater conditions inherent in California's Mediterranean climate.

[2] Jasechko, S. et al. 2021. Widespread potential loss of streamflow into underlying aquifers across the USA. Nature, 591: 391-395. doi: https://doi.org/10.1038/s41586-021-03311-x
[3] The Nature Conservancy. 2021. ICONS Tool. Available at: https://icons.codefornature.org/

The GSP does not provide an inventory of the flora or fauna species present in the basin's GDEs, except to present the common plant species and their rooting depths. Furthermore, the GSP does not acknowledge endangered, threatened, or special status species in the basin.

RECOMMENDATIONS

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape. Map the location of groundwater wells on the contour maps to illustrate monitoring locations in relation to GDEs.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- Include an inventory of the fauna and flora present within the basin's GDEs (see Attachment C of this letter for a list of freshwater species located in the Big Valley Basin). Note any threatened or endangered species.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[4,5] The integration of native vegetation into the water budget is **insufficient**. The water budget did not include the current, historical, and projected demands of native vegetation. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

[4] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[5] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.

- State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development
Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Notice and Communication chapter.[6]

The GSP documents targeted outreach to tribes, including inviting the Pit River Tribe to be a member of the Big Valley Advisory Committee. However, we note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement in very general terms for listed stakeholders. Public outreach and engagement activities include updates to the GSP website and communication portal, community flyers, notices in the local newspaper, social media updates, brochures, and the formation of the Big Valley Advisory Committee. The GSP does not state whether DACs and environmental stakeholders are represented on the Big Valley Advisory Committee.

- The plan does not include documentation on how stakeholder input from the above mentioned outreach and engagement was considered and incorporated into the GSP development process.

- The GSP states the MOU establishing the Big Valley Advisory Committee will expire after the adoption of the GSP. As such, communication and engagement will (p. 11-8) "*shift to the GSA Boards who will continue to inform the public about Plan progress and status of projects and management actions.*" Communication and engagement during implementation will include meetings of County Boards of Supervisors and updates provided to the interested parties list. The GSP does not include a detailed plan for continual opportunities for engagement during GSP implementation that is specifically directed to DACs, domestic well owners, tribes, and environmental stakeholders within the basin.

[6] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

RECOMMENDATIONS
● In the Notice and Communication chapter, describe active and targeted outreach to engage all stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. While some of these resources have already been stated in the GSP, we recommend that the GSAs should improve utilization of these resources and documentation of the engagement process. ● Provide documentation on how stakeholder input was incorporated into the GSP development process. ● Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the basin.[7]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[8,9,10]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, measurable objectives are set at the Fall 2015 water level, or at the lowest water level measured for wells that don't have a Fall 2015 measurement. Minimum thresholds are set at 140 feet below the measurable objective. While acknowledging that lowering of water levels throughout the Basin to the minimum threshold could result in a significant percentage of wells going dry, the GSP does not quantify the number of domestic wells that could go dry or otherwise consider or analyze the impact of minimum thresholds on domestic wells. The GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, nor does it describe how the groundwater level minimum thresholds are consistent with the Human Right to Water policy.[11]

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[7] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[8] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[9] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[10] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[11] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

The GSP states that the undesirable result criterion for the groundwater level sustainability indicator occurs when the groundwater level in one-third of the representative monitoring wells drop below their minimum threshold for five consecutive years. Using this definition of undesirable results for groundwater levels, significant and unreasonable impacts to beneficial users experienced during dry years or periods of drought will not result in an undesirable result. This is problematic since the GSP is failing to manage the basin in such a way that strives to minimize significant adverse impacts to beneficial users, which are often felt greatest in below-average, dry, and drought years. Furthermore, the requirement that one-third of monitoring wells exceed the minimum threshold before triggering an undesirable result means that areas with high concentrations of domestic wells may experience impacts significantly greater than the established minimum threshold because the one-third threshold isn't triggered.

The GSP does not establish SMC for groundwater quality. The GSP states (p. 7-10): *"Due to the existence of excellent water quality in the Basin, significant amount of existing water quality monitoring, generally low impact land uses, and a robust effort to conduct conservation efforts by agricultural and domestic users, per §354.26(d), SMCs were not established for water quality because Undesirable Results are not present and not likely to occur."* However, the GSP states (p. 7-9): *"After a review of the best available data on water quality in the Basin, it was concluded that all the constituents which were elevated above suitable thresholds are naturally occurring. There has been no identifiable increase in the level of concentrations over time, and several constituents have indications of improvement in recent decades compared to concentrations in the 1950s and 1960s."* All COCs in the basin that may be impacted or exacerbated by groundwater use and/or management should have established SMC, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels. Include information on the impacts during prolonged periods of below average water years.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users, DACs, and tribes within the basin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be fully or partially de-watered at the minimum threshold.

- Consider minimum threshold exceedances during drought years when defining the groundwater level undesirable result across the basin.

Degraded Water Quality

- Establish water quality SMC. Set minimum thresholds and measurable objectives for all water quality constituents within the basin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management.

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality.[12] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[13]
- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the basin, they must be considered when developing SMC.

The GSP does not establish SMC for depletion of interconnected surface water. The GSP acknowledges data gaps for interconnected surface water and states (p. 7-11): *"At the five-year update, SMCs will be considered only if the trends indicate that undesirable results are likely to occur in the subsequent 5 years."* The GSP continues (p. 7-11): *"While Chapter 5 – Groundwater Conditions details the streams in Big Valley which may be interconnected by a "…continuous saturated zone to the underlying aquifer and the overlying surface water…" (DWR 2016c), there is currently no evidence to support interconnected surface water. Therefore, there is a lack of evidence for interconnection of streams."* However, the absence of evidence is not evidence of absence. The GSP should establish interim SMC for the depletion of interconnected surface water condition indicator until more data is gathered. The GSP should discuss how the interim SMC will affect beneficial users, and more specifically GDEs, and the impact of these minimum thresholds on GDEs in the basin. The GSP should evaluate how the proposed minimum thresholds and measurable objectives will avoid significant and unreasonable effects on surface water beneficial users in the basin (see Attachment C for a list of environmental users in the basin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When establishing SMC for the basin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."
- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable'

[12] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]
[13] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the basin.[14] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[15]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the basin are reached.[16] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[8,17]

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[18] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[19] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors. However, the plan does not clearly indicate which DWR change factors (2030, 2070, or both) were incorporated into the projected water budget. In addition, the GSP does not indicate whether multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) were considered in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios

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[14] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[15] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[16] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[17] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[18] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[19] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

provided by DWR into projected water budgets or select more appropriate extreme scenarios for the basin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

The GSP integrates climate change into key inputs (e.g., changes in precipitation, evapotranspiration, and surface water flow) of the projected water budget. However, the sustainable yield is based on the historic water budget, instead of the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios and the omission of climate change projections in the sustainable yield calculations, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, tribes, and domestic well owners.

RECOMMENDATIONS
● Clearly indicate which of the DWR change factors (2030, 2070, or both) were incorporated into the projected water budget. ● Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions ● Calculate sustainable yield based on the projected water budget with climate change incorporated. ● Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Wells (RMWs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, tribes, GDEs, and ISWs in the subbasin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[20]

Figure 8-1 (Water Level Monitoring Networks) shows insufficient representation of GDEs, DACs, drinking water users, and tribes for shallow groundwater elevation monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater.

The GSP has not established SMC or a monitoring network for water quality. As stated above in the SMC section of this letter, concentrations of COCs in the basin may be impacted or exacerbated by groundwater use and/or management, and therefore must be monitored. The GSAs should conduct and report water quality monitoring in coordination with the other water quality regulatory programs discussed in the GSP.

[20] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

As stated in Section 8.2.1.3 of the GSP, a representative monitoring network for ISW has not been established in the basin. Section 9.2.3 acknowledges that (p. 9-13) *"monitoring could aid in the analysis of the relationship between groundwater levels and GDEs."* However, the GSP fails to provide specific plans for establishing a monitoring network to adequately assess the presence of GDEs and ISWs, and to monitor the impact of SMC on these ecosystems.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, tribes, and GDEs to clearly identify monitored areas.
- Increase the number of RMWs in the shallow aquifer across the basin as needed to map ISWs and adequately monitor all groundwater condition indicators across the basin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, tribes, GDEs, and ISWs when identifying new RMWs.
- Ensure groundwater elevation and water quality RMWs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, tribes, and GDEs.
- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the basin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, tribes, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

We commend the GSAs for including projects and management actions with explicit environmental benefits, such as Agriculture Managed Aquifer Recharge (Section 9.1.1.) and Forest Health / Conifer and Juniper Thinning (Section 9.4.1). However, the GSP fails to describe this or other projects' explicit benefits or impacts to beneficial users such as DACs and tribes.

We note that the plan does not include a domestic well mitigation program to avoid significant and unreasonable loss of drinking water. We strongly recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation.

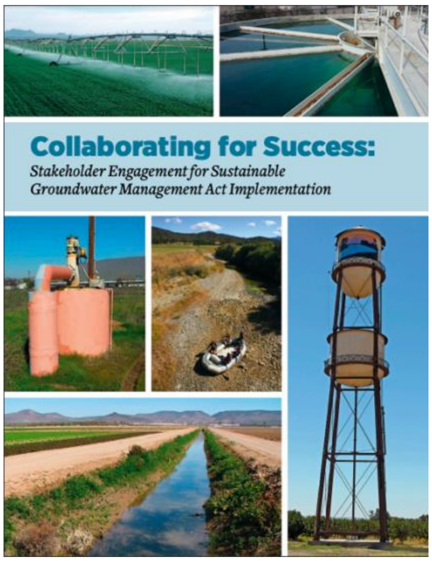
RECOMMENDATIONS
• For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program. • For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSAs plan to mitigate such impacts. • Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[21] • Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[21] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

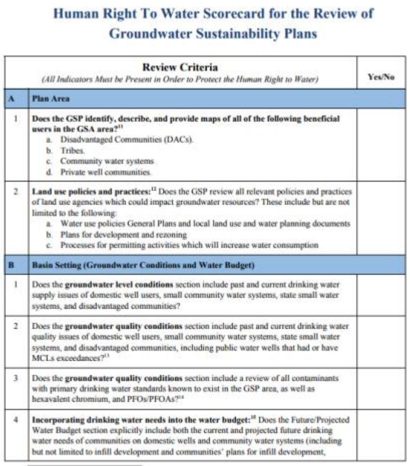
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

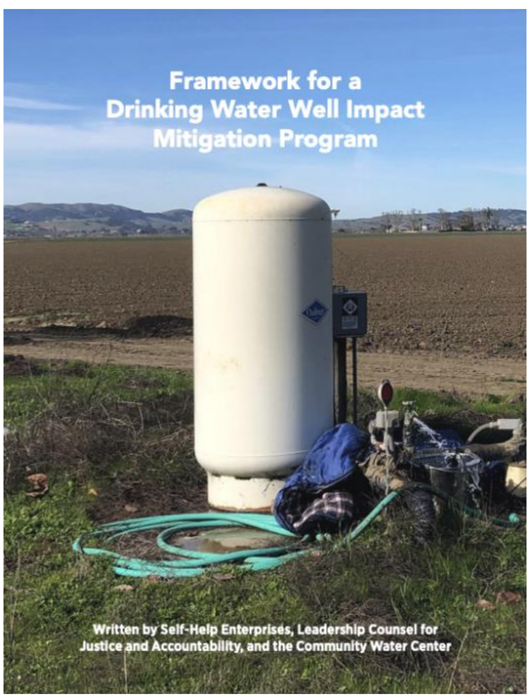


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria (All Indicators Must be Present in Order to Protect the Human Right to Water)	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

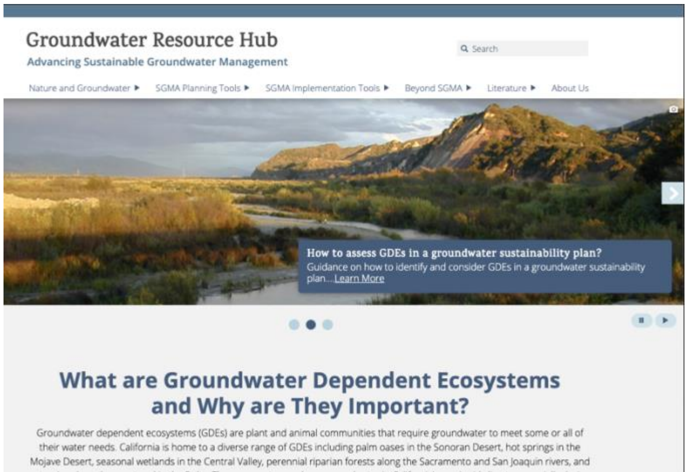
The [Human Right to Water Scorecard] was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



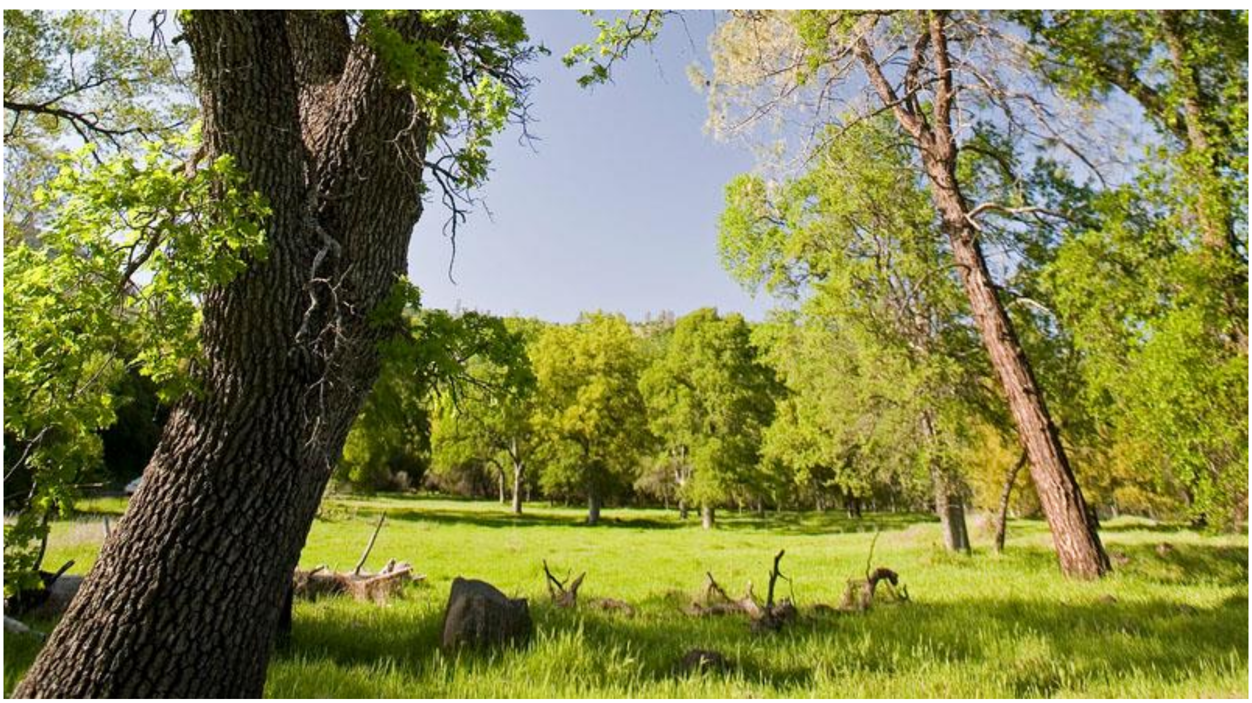
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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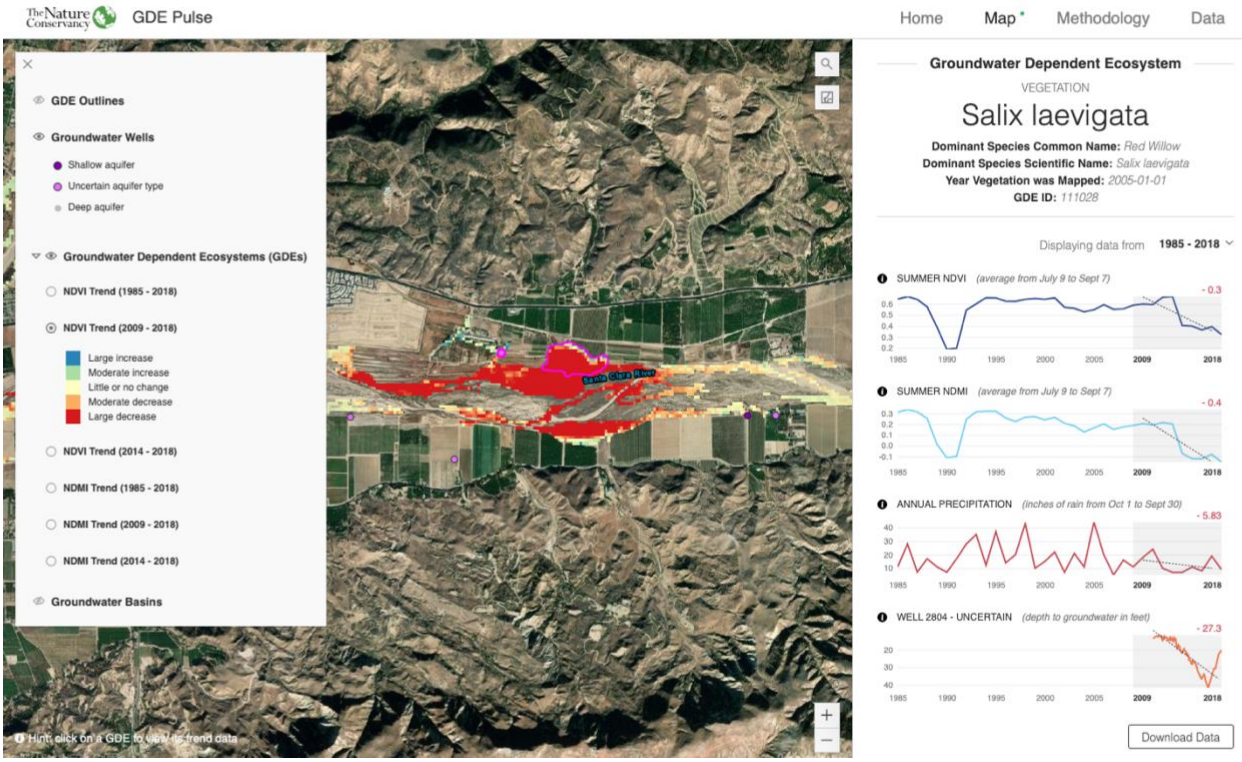
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

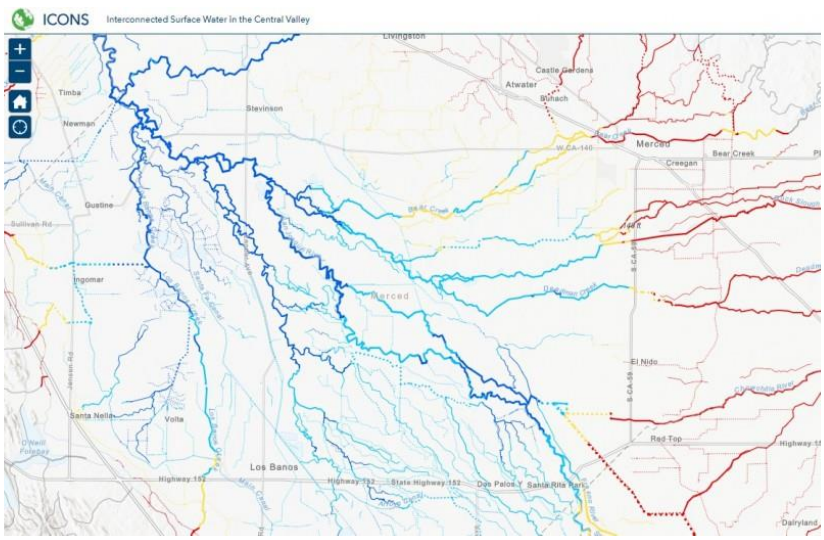
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data [available online](#) from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Big Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Big Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Grus canadensis tabida	Greater Sandhill Crane		Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			

Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Calasellus californicus	An Isopod		Special	
Cambaridae fam.	Cambaridae fam.			
Cyprididae fam.	Cyprididae fam.			
Hyalella azteca	An Amphipod			
Hyalella spp.	Hyalella spp.			
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Dicamptodon ensatus	California Giant Salamander			ARSSC
Dicamptodon tenebrosus	Pacific Giant Salamander			
Lithobates pipiens	Northern Leopard Frog		Special Concern	ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Taricha rivularis	Red-bellied Newt			ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis sirtalis sirtalis	Common Gartersnake			

Pseudacris regilla	Northern Pacific Chorus Frog			
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Dubiraphia brunnescens	Brownish Dubiraphian Riffle Beetle		Special	
Ablabesmyia spp.	Ablabesmyia spp.			
Acentrella spp.	Acentrella spp.			
Aeshnidae fam.	Aeshnidae fam.			
Ambrysus mormon				Not on any status lists
Ampumixis dispar				Not on any status lists
Anopheles spp.	Anopheles spp.			
Baetidae fam.	Baetidae fam.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Berosus spp.	Berosus spp.			
Brachycentrus occidentalis				Not on any status lists
Brachycentrus spp.	Brachycentrus spp.			
Caenis spp.	Caenis spp.			
Callibaetis spp.	Callibaetis spp.			
Cenocorixa wileyae				Not on any status lists
Centroptilum spp.	Centroptilum spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Chloroperlidae fam.	Chloroperlidae fam.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corisella spp.	Corisella spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Dubiraphia spp.	Dubiraphia spp.			
Dytiscidae fam.	Dytiscidae fam.			
Enallagma spp.	Enallagma spp.			
Epeorus spp.	Epeorus spp.			
Ephemerella spp.	Ephemerella spp.			
Ephydridae fam.	Ephydridae fam.			
Fallceon quilleri	A Mayfly			

Glossosoma alascense	A Caddisfly			
Glossosoma spp.	Glossosoma spp.			
Goera archaon	A Caddisfly			
Haliplus spp.	Haliplus spp.			
Heptagenia spp.	Heptagenia spp.			
Heptageniidae fam.	Heptageniidae fam.			
Hesperocorixa laevigata				Not on any status lists
Hesperocorixa spp.	Hesperocorixa spp.			
Hesperoperla pacifica	Golden Stone			
Hetaerina americana	American Rubyspot			
Hexagenia limbata	A Mayfly			
Hydropsyche alternans				Not on any status lists
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila spp.	Hydroptila spp.			
Ischnura spp.	Ischnura spp.			
Isonychia intermedia				Not on any status lists
Isonychia spp.	Isonychia spp.			
Isonychia velma	A Mayfly			
Isoperla spp.	Isoperla spp.			
Laccophilus spp.	Laccophilus spp.			
Lepidostoma spp.	Lepidostoma spp.			
Libellula nodisticta	Hoary Skimmer			
Limnophyes spp.	Limnophyes spp.			
Liodessus obscurellus				Not on any status lists
Malenka spp.	Malenka spp.			
Micropsectra spp.	Micropsectra spp.			
Mideopsis spp.	Mideopsis spp.			
Nectopsyche spp.	Nectopsyche spp.			
Neophylax spp.	Neophylax spp.			
Neotrichia spp.	Neotrichia spp.			
Nixe kennedyi	A Mayfly			
Notonecta spp.	Notonecta spp.			
Ophiogomphus spp.	Ophiogomphus spp.			
Optioservus canus	Pinnacles Optioservus Riffle Beetle		Special	
Optioservus quadrimaculatus				Not on any status lists
Optioservus spp.	Optioservus spp.			
Ordobrevia nubifera				Not on any status lists

Paraleptophlebia spp.	Paraleptophlebia spp.			
Peltodytes callosus				Not on any status lists
Peltodytes spp.	Peltodytes spp.			
Petrophila spp.	Petrophila spp.			
Plathemis lydia	Common Whitetail			
Procladius spp.	Procladius spp.			
Protoptila balmorhea				Not on any status lists
Protoptila spp.	Protoptila spp.			
Psectrocladius spp.	Psectrocladius spp.			
Psephenus falli				Not on any status lists
Pseudochironomus spp.	Pseudochironomus spp.			
Pteronarcys californica	Giant Salmonfly			
Pteronarcys spp.	Pteronarcys spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhithrogena spp.	Rhithrogena spp.			
Rhyacophila spp.	Rhyacophila spp.			
Sanfilippodytes spp.	Sanfilippodytes spp.			
Serratella spp.	Serratella spp.			
Sialis spp.	Sialis spp.			
Sigara spp.	Sigara spp.			
Simulium anduzei				Not on any status lists
Simulium spp.	Simulium spp.			
Skwala americana	American Springfly			
Sperchon spp.	Sperchon spp.			
Stictotarsus spp.	Stictotarsus spp.			
Taeniopteryx nivalis	Boreal Willowfly			
Tanypus spp.	Tanypus spp.			
Tanytarsus spp.	Tanytarsus spp.			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
Zaitzevia parvula				Not on any status lists
Zaitzevia spp.	Zaitzevia spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists

Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Helisoma minus	A Freshwater Snail			E
Anodonta californiensis	California Floater		Special	
Ferrissia spp.	Ferrissia spp.			
Fluminicola turbiniformis	Turban Pebblesnail			V
Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus spp.	Gyraulus spp.			
Hydrobiidae fam.	Hydrobiidae fam.			
Lanx klamathensis	Scale Lanx		Special	E
Lymnaea spp.	Lymnaea spp.			
Lymnaeidae fam.	Lymnaeidae fam.			
Margaritifera falcata	Western Pearlshell		Special	
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Sphaeriidae fam.	Sphaeriidae fam.			
Sphaerium spp.	Sphaerium spp.			
Valvata spp.	Valvata spp.			
PLANTS				
Carex sheldonii	Sheldon's Sedge		Special	CRPR - 2B.2
Downingia laeta	Great Basin Downingia		Special	CRPR - 2B.2
Ranunculus macounii	Macoun's Buttercup		Special	CRPR - 2B.2
Scutellaria galericulata	Hooded Skullcap		Special	CRPR - 2B.2
Alisma triviale	Northern Water-plantain			
Alopecurus aequalis aequalis	Short-awn Foxtail			
Alopecurus carolinianus	Tufted Foxtail			
Alopecurus geniculatus geniculatus	Meadow Foxtail			
Alopecurus pratensis	NA			
Alopecurus saccatus	Pacific Foxtail			
Arundo donax	NA			
Beckmannia syzigachne	American Sloughgrass			
Bidens cernua	Nodding Beggarticks			

Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche palustris	Vernal Water-starwort			
Calochortus uniflorus	Shortstem Mariposa Lily		Special	CRPR - 4.2
Carex integra	Smooth-beak Sedge			
Carex lasiocarpa	Slender Sedge		Special	CRPR - 2B.3
Carex nebrascensis	Nebraska Sedge			
Carex pellita	Woolly Sedge			
Damasonium californicum				Not on any status lists
Downingia bacigalupii	Bacigalup's Downingia			
Downingia cuspidata	Toothed Calicoflower			
Downingia elegans	NA			
Downingia insignis	Parti-color Downingia			
Elatine californica	California Waterwort			
Elatine rubella	Southwestern Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Elodea canadensis	Broad Waterweed			
Epilobium campestre	NA			Not on any status lists
Epilobium hallianum				Not on any status lists
Eryngium alismifolium	Inland Coyote-thistle			
Eryngium aristulatum aristulatum	California Eryngo			
Eryngium articulatum	Jointed Coyote-thistle			
Eryngium mathiasiae	Mathias' Coyote-thistle			
Euthamia occidentalis	Western Fragrant Goldenrod			
Floerkea proserpinacoides	False Mermaidweed			
Glyceria borealis	Small Floating Mannagrass			

Gratiola ebracteata	Bractless Hedge-hyssop			
Gratiola heterosepala	Boggs Lake Hedge-hyssop		Endangered	CRPR - 1B.2
Gratiola neglecta	Clammy Hedge-hyssop			
Juncus uncialis	Inch-high Rush			
Lemna minor	Lesser Duckweed			
Lemna minuta	Least Duckweed			
Limosella acaulis	Southern Mudwort			
Limosella aquatica	Northern Mudwort			
Ludwigia palustris	Marsh Seedbox			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus latidens	Broad-tooth Monkeyflower			
Myosurus apetalus	Bristly Mousetail			
Myosurus minimus	NA			
Navarretia heterandra	Tehama Navarretia			
Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala minima	Least Navarretia			
Perideridia oregana	Oregon Yampah			
Persicaria amphibia				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Phacelia distans	NA			
Phalaris arundinacea	Reed Canarygrass			
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Pogogyne douglasii	NA			
Porterella carnosula	Western Porterella			
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton pusillus pusillus	Slender Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			

Psilocarphus oregonus	Oregon Woolly-heads			
Ranunculus aquatilis aquatilis	White Water Buttercup			
Ranunculus aquatilis diffusus				Not on any status lists
Rorippa curvipes	Rocky Mountain Yellowcress			
Rumex salicifolius salicifolius	Willow Dock			
Rumex triangulivalvis				Not on any status lists
Sagittaria cuneata	Wapatum Arrowhead			
Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Salix exigua exigua	Narrowleaf Willow			
Salix exigua hindsiana				Not on any status lists
Salix gooddingii	Gooding's Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lutea	Yellow Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Scirpus microcarpus	Small-fruit Bulrush			
Senecio hydrophiloides	Sweet Marsh Ragwort		Special	CRPR - 4.2
Senecio hydrophilus	Great Swamp Ragwort			
Sidalcea oregana oregana	Oregon Checker-mallow			
Spirodela polyrhiza	NA			
Stuckenia pectinata				Not on any status lists
Symphyotrichum frondosum	Alkali Aster			
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	NA			
Veronica catenata	NA			Not on any status lists

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

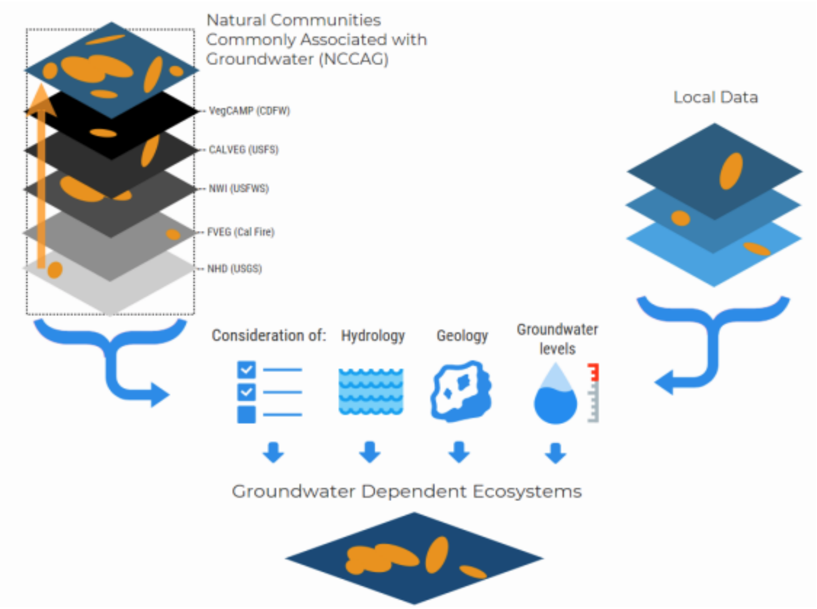


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

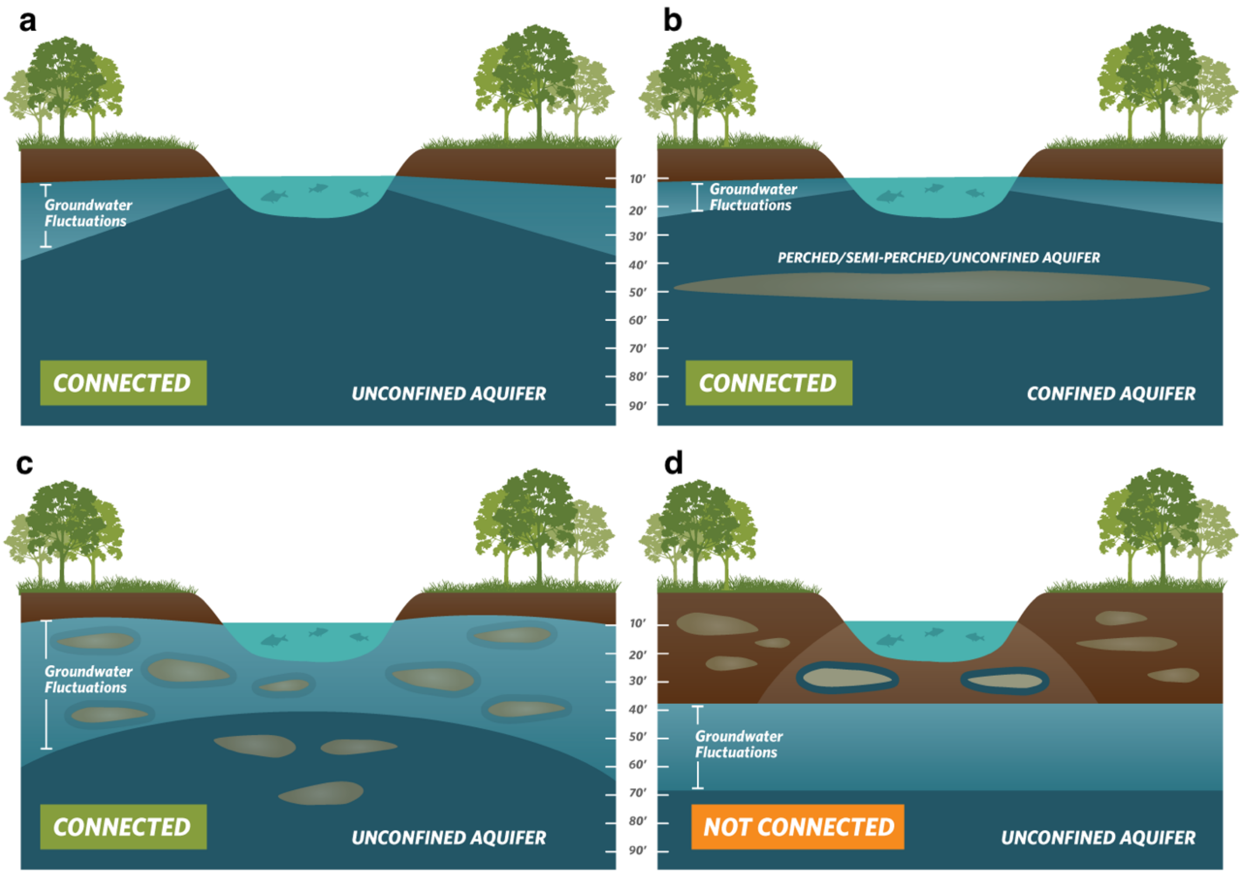

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

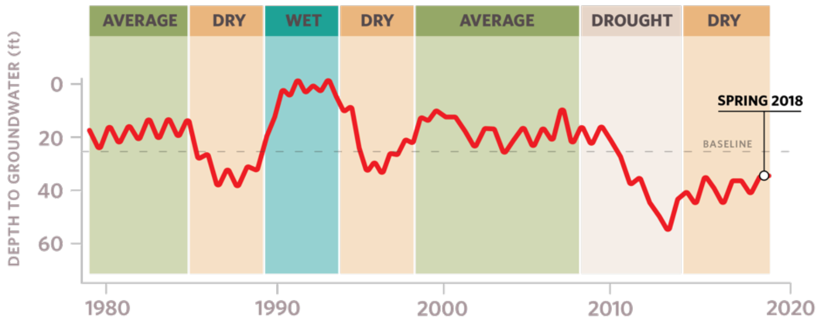

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

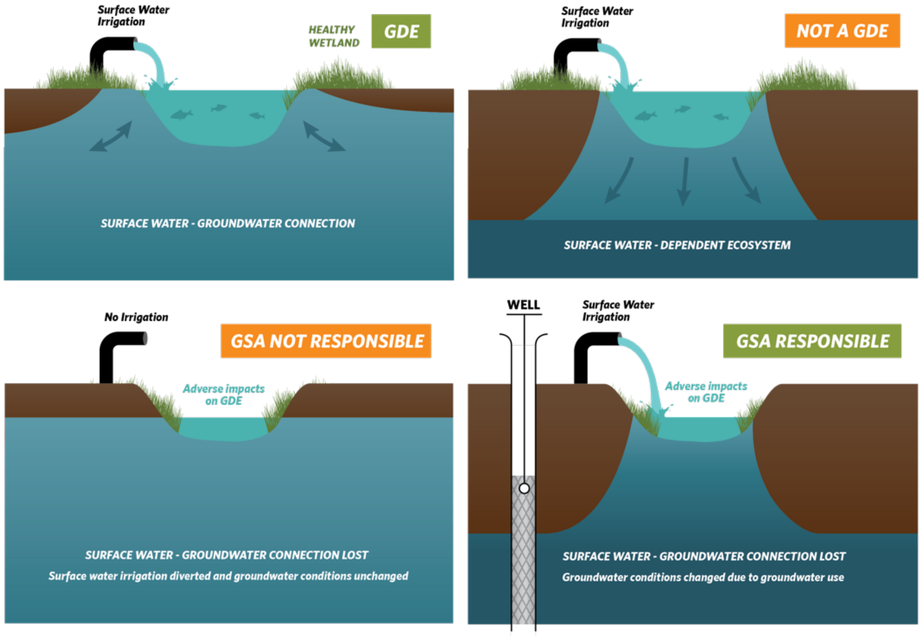

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

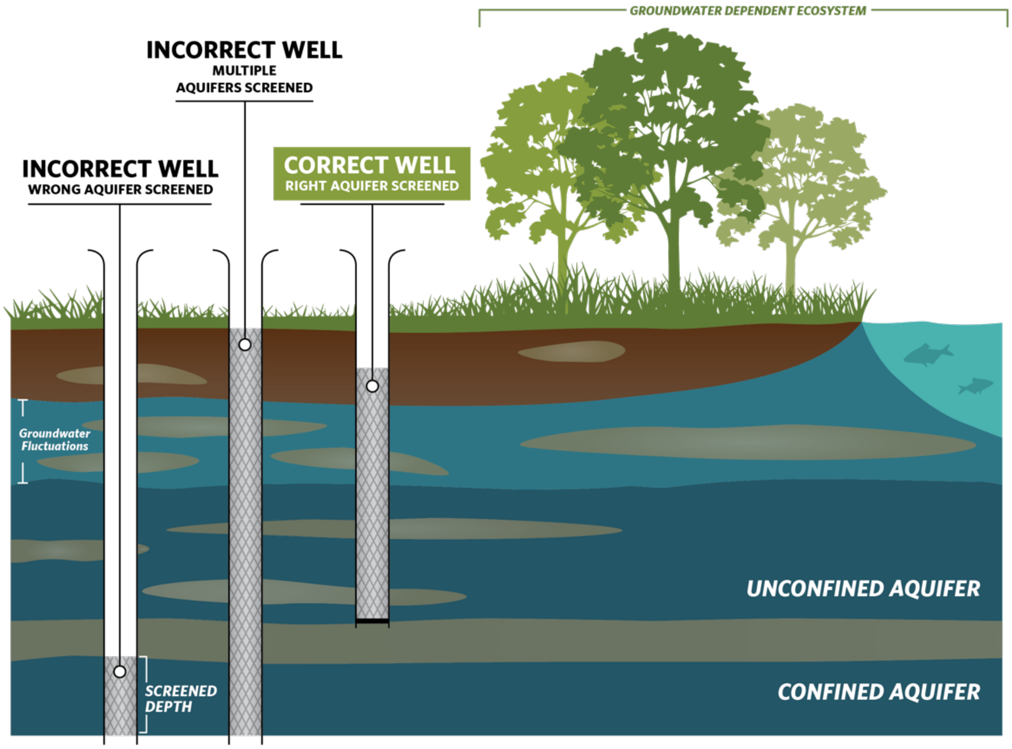

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

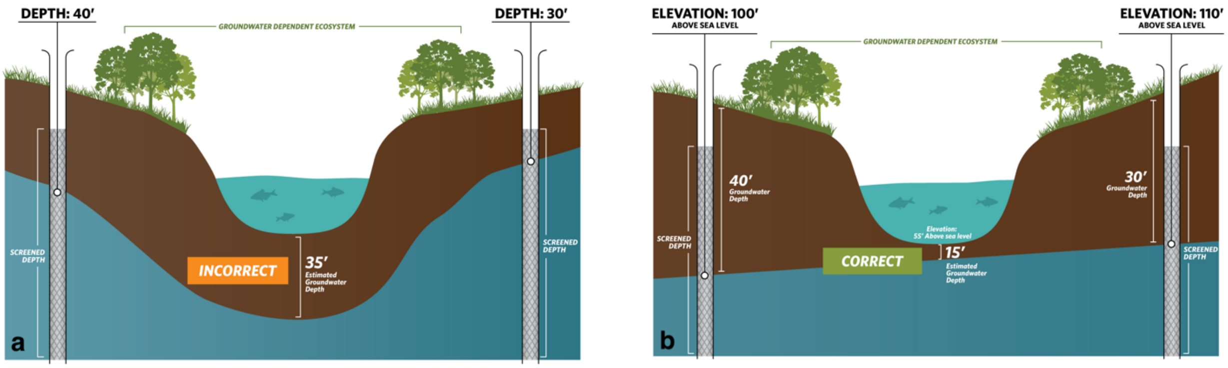

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

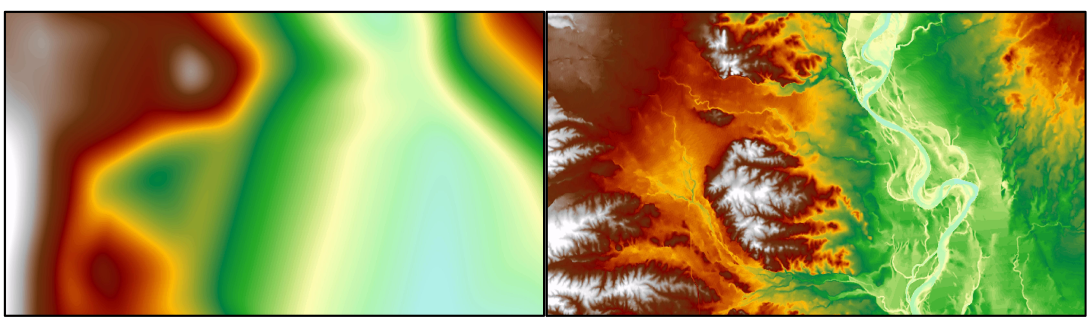

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

December 3, 2021

Big Valley Groundwater Sustainability Agency
255 N. Forbes Street, Room 309
Lakeport, CA 95453

Submitted via email: water.resources@lakecountyca.gov

Re: Public Comment Letter for Big Valley Basin Draft GSP

Dear Scott De Leon,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Big Valley Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Big Valley Basin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment D	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Big Valley Basin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**, due to lack of a map labeling the community of Kelseyville as a severely disadvantaged community (SDAC). Figure 2-1 (Big Valley Basin Boundaries, Communities, and Public Lands) shows Kelseyville, but it is not clearly labeled as an SDAC nor is the source of data provided (i.e., DAC places, tracks, or block data). We recommend that this missing element be included to provide a complete description of DACs in the basin.

Despite this omission, we commend the GSA for clearly identifying Kelseyville as a SDAC in the GSP text, providing its population, and identifying that it is dependent on groundwater as its source of drinking water in the basin. Additionally, the GSP maps tribal lands of the Big Valley Band of Pomo Indians of the Big Valley Rancheria on Figure 2-1. The GSP also provides a density map of domestic wells in the basin (Figure 2-5), which shows the average domestic well depth within each grid cell.

RECOMMENDATIONS
• Clearly label the community of Kelseyville as an SDAC. State the data used to map the community (i.e., DAC places, tracks, or block data).

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP discusses available stream gauge data in the basin, and compares the profile of channels (Kelsey Creek and Adobe Creek) with the groundwater elevations along the creek channels for representative wet and dry conditions (Fall 2015 and Spring 2019). However, the GSP does not provide a map of stream reaches in the basin to illustrate the conclusions of the ISW analysis and show which reaches are connected to groundwater.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

The GSP recognizes that most available groundwater elevation data in the basin are from deep wells which may not be representative of the shallow aquifer. The GSP states: (p. 3-18): *"The interconnected surface water monitoring network could be improved through the installation of multi-completion wells closer to the Kelsey and Adobe Creek stream gage stations. Also surface water monitoring (stage and flow) on Kelsey Creek near the Main Street bridge should be conducted in the future. Opportunities to fill data gaps for depletions will also benefit the understanding of GDEs located downstream of the KCK stream gage. In addition, stream flow monitoring of McGaugh Slough could also be considered. The District will coordinate with Big Valley Rancheria regarding stream gage monitoring protocols so that data collection efforts and quality are consistent with the GSP."* We recommend that any segments with data gaps are considered potential ISWs and clearly marked as such on maps provided in the GSP.

RECOMMENDATIONS

- Provide a map showing all the stream reaches in the basin, with reaches clearly labeled as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.
- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.
- Overlay the basin's stream reaches on depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis.
- For the depth-to-groundwater contour maps, use the best practices presented in Attachment C. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.
- Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **incomplete**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). The GSP uses depth-to-groundwater data from 1985 to 2019 to characterize groundwater conditions in the basin's GDEs. However, we found that some mapped features in the NC dataset were improperly disregarded. NC dataset polygons were incorrectly removed in areas adjacent to irrigated fields or due to the presence of surface water supplies. However, this removal criteria is flawed since GDEs, in addition to groundwater, can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields – simultaneously and at different temporal/spatial scales. NC dataset polygons adjacent to irrigated land or surface water supplies can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to irrigated fields or surface water supplies.

The GSP states (p. 2-92): *"Oak trees are considered amongst the most common plants and also the deepest-rooted species in the region, with a maximum root zone of roughly 30 feet."* If Valley Oaks exist in the basin, we recommend instead that an 80-foot depth-to-groundwater threshold be used when inferring whether Valley Oak polygons in the NC Dataset GDE map are likely reliant on groundwater. This recommendation is based on a recent correction in TNC's rooting depth database,[2] after finding a typo in the max rooting depth units for Valley Oak. This resulted in a specific change in the max rooting depth of Valley Oak from 24 feet to 24 meters (80 feet). For all other phreatophytes, we continue to recommend that a 30-foot depth-to-groundwater threshold be used when inferring whether all other vegetation polygons are likely reliant on groundwater.

RECOMMENDATIONS

- Re-evaluate the NC dataset polygons that are adjacent to irrigated fields or surface water supplies. Refer to Attachment C of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as Valley Oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used if these species are present in the basin. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether Valley Oak polygons are connected to groundwater.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[3,4] The integration of native vegetation into the water budget is **insufficient**. The GSP text discusses evapotranspiration from native vegetation as a separate water use sector, but native vegetation appears to be grouped into a category with all evapotranspiration in the water budget tables. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project

[2] TNC. 2021. Plant Rooting Depth Database. Available at: https://groundwaterresourcehub.org/sgma-tools/gde-rooting-depths-database-for-gdes/

[3] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[4] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.

- State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development

Stakeholder engagement during GSP development is **incomplete**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Communication and Engagement Plan (Appendix 7A).[5]

The GSP documents explicit involvement of beneficial users through the GSP Advisory Committee, which includes designated seats for DAC, tribal, and environmental representation. However, we note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement as the following: GSP development meetings, Board of Directors briefings, public meetings and workshops, community presentations, partnerships with local organizations, and in-person outreach at community events. However, the plan does not include documentation on how stakeholder input from the above mentioned outreach and engagement was considered and incorporated into the GSP development process.

- Page 7-1 of the Communication and Engagement Plan states that the GSA will continue to hold regular public meetings during the GSP implementation phase. However, the plan does not include strategies to improve outreach and engagement during GSP implementation. It is also unclear whether the GSP Advisory Committee will continue to be actively involved in the GSP implementation process.

RECOMMENDATIONS

- Provide clear documentation on how stakeholder input was incorporated into the GSP development process.

[5] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- Clarify the role of the GSP Advisory Committee in the GSP implementation phase.

- Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the basin.[6]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[7,8,9]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, minimum thresholds were set to the lowest historical spring groundwater elevation, plus an operational flexibility margin, at each representative monitoring site (RMS). Hydrographs for each of the six RMS show horizontal lines representing groundwater elevations for 5%, 10%, and 20% of domestic wells (Figures 4-1 to 4-6). The GSP text does not provide justification or explain how these lines were developed or what exactly they represent (e.g., total well depth or top of screen depth). At the six RMS, minimum thresholds range from groundwater elevations above the 5% of domestic well line to groundwater elevations between the 10% and 20% lines. Besides the lack of justification or explanation of the lines shown on the hydrographs, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, nor does it describe how the groundwater level minimum thresholds are consistent with the Human Right to Water policy.[10]

The GSP states (p. 4-6): *"Undesirable results would occur when 33 percent (two of six wells) of RMS used to monitor groundwater levels fall below their MTs for two consecutive years at the same sites."* The requirement that 33% of monitoring wells exceed the minimum threshold before triggering an undesirable result and the limited RMS wells means that areas with high concentrations of domestic wells may experience impacts significantly greater than the established minimum threshold.

For degraded water quality, the GSP establishes SMC for TDS, and states that TDS is monitored as an overall indicator of groundwater quality within the basin. The minimum threshold for TDS is

[6] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[7] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[8] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[9] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[10] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

750 milligrams per liter (mg/L). This is the only constituent of concern (COC) for which SMC are established. The GSP states (p. 4-13): *"There are other water quality concerns within the Big Valley Basin that are outside the purview of the GSA and are covered by other regulatory programs and are without a causal nexus to groundwater pumping, including: Naturally occurring constituents such as iron, manganese, boron, and arsenic; Constituents from human activities (urban, agricultural, and industrial) that are not managed under SGMA. These constituents may include nitrate, salts, pesticides, and herbicides from agricultural and urban uses, which are managed by other programs such as Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS), Irrigated Lands Regulatory Program, and Department of Pesticide Regulation."* Significantly, nitrate is an acute contaminant which, at levels above the maximum contaminant level, can affect public health. This is a particular concern for domestic wells, as nitrate exceedances do not affect the taste or smell of the water. All COCs in the basin that may be impacted or exacerbated by groundwater use and/or management should be included in the SMC, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs, domestic well owners, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels. Include information on the impacts during prolonged periods of below average water years.
- Consider minimum threshold exceedances for single RMS wells when defining the groundwater level undesirable result across the basin, instead of exceedances at two out of six RMS wells.

Degraded Water Quality

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when defining undesirable results for degraded water quality.[11] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[12]
- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs, drinking water users, and tribes.
- Set minimum thresholds and measurable objectives for all water quality constituents within the basin that are impacted or exacerbated by groundwater use and/or management.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining

[11] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[12] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

undesirable results. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the basin, they must be considered when developing SMC for chronic lowering of groundwater levels.

Sustainable management criteria for depletion of interconnected surface water are established by proxy using groundwater levels. The GSP notes the data gap for shallow groundwater elevations, which make the use of groundwater elevations suitable for use by proxy. In the interim, the GSP uses groundwater levels from available deep monitoring wells in the proximity of surface water gages as proxy for groundwater depletions. At these RMS, lowest historical spring (April or March) groundwater level was identified as the minimum threshold, and capped to not exceed a depth of 30 feet below ground surface (bgs). All minimum thresholds are less than 30 feet bgs, and range from 14.9 ft bgs to 29.7ft bgs. While ensuring that the minimum thresholds do not exceed 30 feet bgs is a good first step, we recommend that the GSP include analysis or discussion to further describe how the SMC will affect GDEs, and the impact of these minimum thresholds on GDEs in the subbasin. We also recommend that the GSP evaluate how the proposed minimum thresholds and measurable objectives will avoid significant and unreasonable effects on surface water beneficial users in the basin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- Evaluate impacts on GDEs when establishing SMC for chronic lowering of groundwater levels. When defining undesirable results, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when ‘significant and unreasonable’ effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the basin.[13] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[14]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the basin are reached.[15] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected

[13] “The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results”. [23 CCR §354.26(b)(3)]

[14] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.” [23 CCR §354.28(b)(4)]

[15] “The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results.” [23 CCR §354.28(c)(6)]

by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[8,16]

- When establishing SMC for the basin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[17] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[18] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **sufficient**. We commend the GSA for its comprehensive inclusion of the impacts of climate change into the GSP. The GSP incorporates climate change into the projected water budget using two different global climate models (CNRM-CM5 RCP4.5 and HadGEM2-ES RCP8.5). Under the HadGEM2-ES model, the GSP incorporated a more extreme climate scenario using RCP 8.5 in the projected water budget. While extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, and thus we commend the GSA for including extreme scenarios in the basin's approach to groundwater management.

The GSP integrates climate change into key inputs (e.g., changes in precipitation, evapotranspiration, and surface water flow) of the projected water budget. We recommend that imported water, which is currently included in the "Non-Routed Delivery" column, be included as its own line item in the water budget tables to clearly communicate and quantify the changes in this input to the different water budgets.

RECOMMENDATIONS

- Include imported water, which is currently included in the "Non-Routed Delivery" column, as its own line item in the water budget tables.
- Incorporate climate change scenarios into projects and management actions.

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[16] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[17] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[18] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, tribes, GDEs, and ISWs in the basin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[19]

Figure 3-2 (Representative Monitoring Networks) shows insufficient representation of drinking water users and GDEs for the groundwater elevation and water quality monitoring network. Figure 3-2 shows sufficient spatial representation of DACs and tribes for the monitoring network, however depth representation cannot be determined from the information provided in the GSP. Refer to Attachment D for maps of these monitoring sites in relation to key beneficial users of groundwater.

The GSP states (p. 3-6): *"No RMS well was selected for the southeast grid, as this grid lies primarily in upland areas with available wells generally shallow and located near surface water sources."* We note that the southeast grid is one of the areas of the basin with the highest concentration of domestic wells (see our maps in Attachment D). There are also potential GDEs in this area. We recommend inclusion of one or more shallow wells in this grid quadrant into the RMS network.

The GSP provides discussion of data gaps for GDEs and ISWs in the Monitoring Network section of the GSP. The GSP (p. 3-18) states: "*Opportunities to fill data gaps for depletions will also benefit the understanding of GDEs located downstream of the KCK stream gage. In addition, stream flow monitoring of McGaugh Slough could also be considered*." However, the GSP proposes filling data gaps based on funding availability and level of need. The plan does not provide specific plans, such as locations or a timeline, to fill the data gaps.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, tribes, and GDEs to clearly identify monitored areas. Include a shallow well in the southeast grid of the basin to monitor impacts to beneficial users.
- Increase the number of RMSs in the shallow aquifer across the basin as needed to map ISWs and adequately monitor all groundwater condition indicators across the basin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, tribes, GDEs, and ISWs when identifying new RMSs.
- Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, tribes, and GDEs.

[19] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the basin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, tribes, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

While the plan describes investigations for locating potential recharge projects within the basin, there are no concrete plans for groundwater recharge currently in place during the GSP planning horizon. Moreover, the GSP fails to describe this or other projects' explicit benefits or impacts to other beneficial users such as DACs.

We note that the plan includes a domestic well mitigation program (Section 5.3.5.4) that will be implemented upon adoption of the GSP. We recommend that the GSP further describes the well mitigation program's benefits to DACs within the basin.

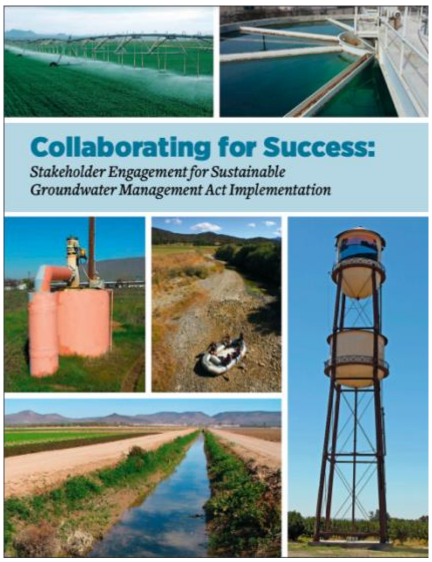
RECOMMENDATIONS

- For DACs and domestic well owners, further describe specific plans for implementation of the drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.
- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



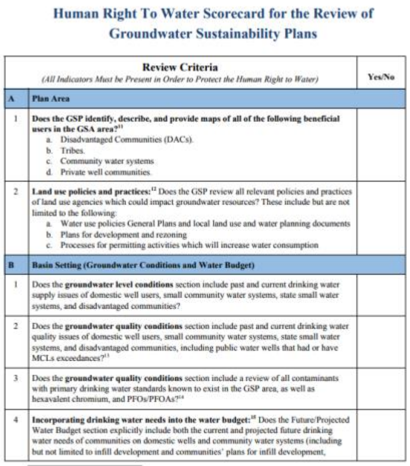
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

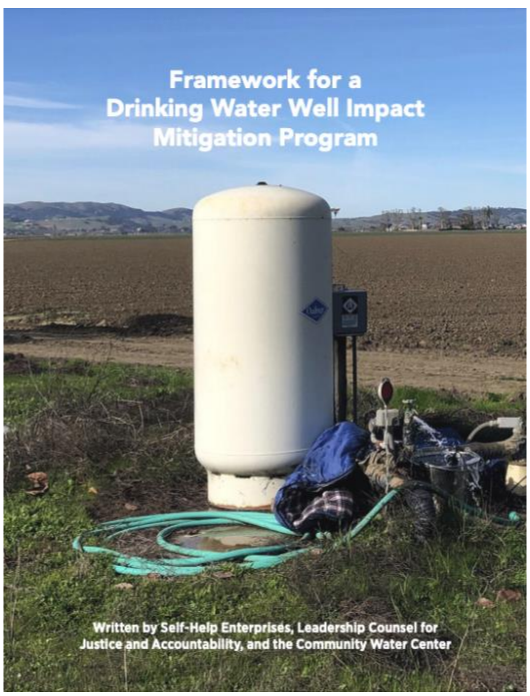


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

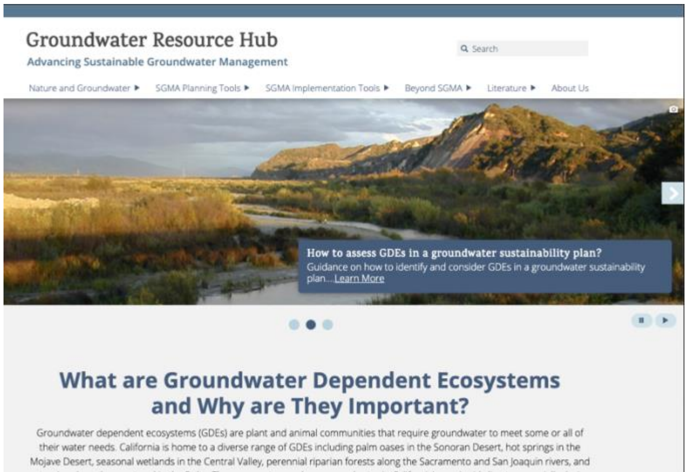
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



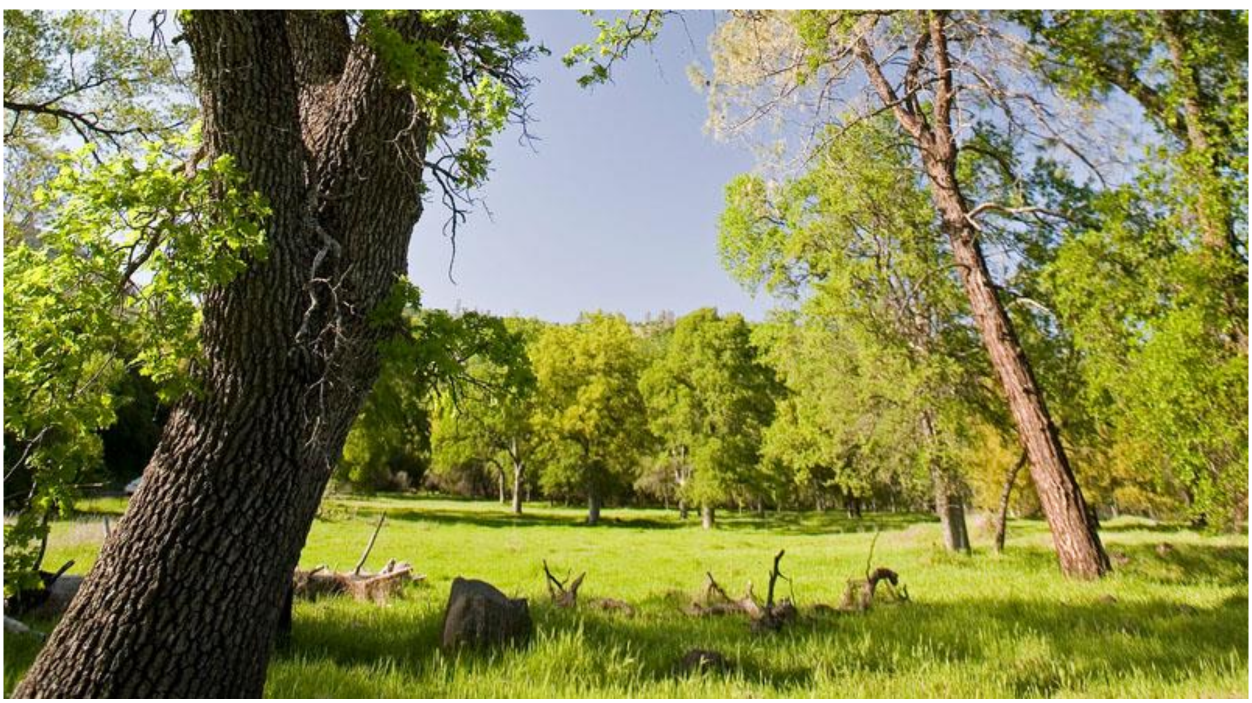
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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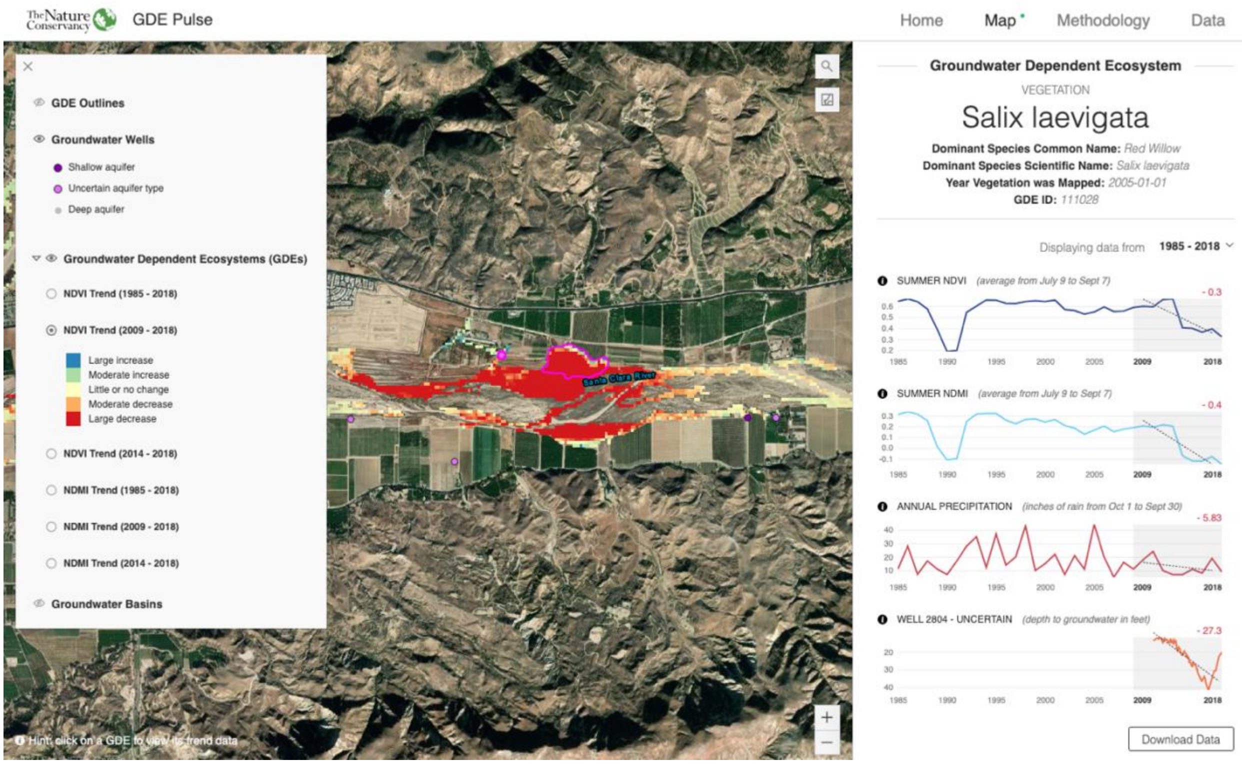
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

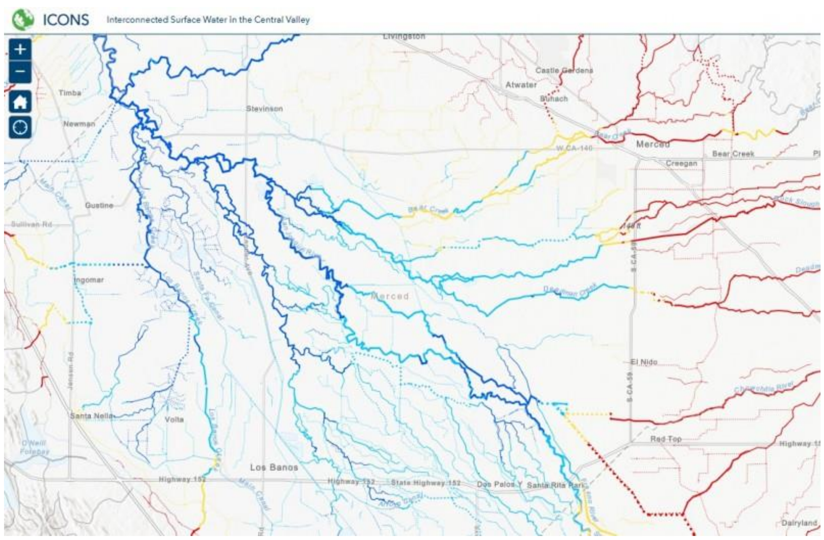
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

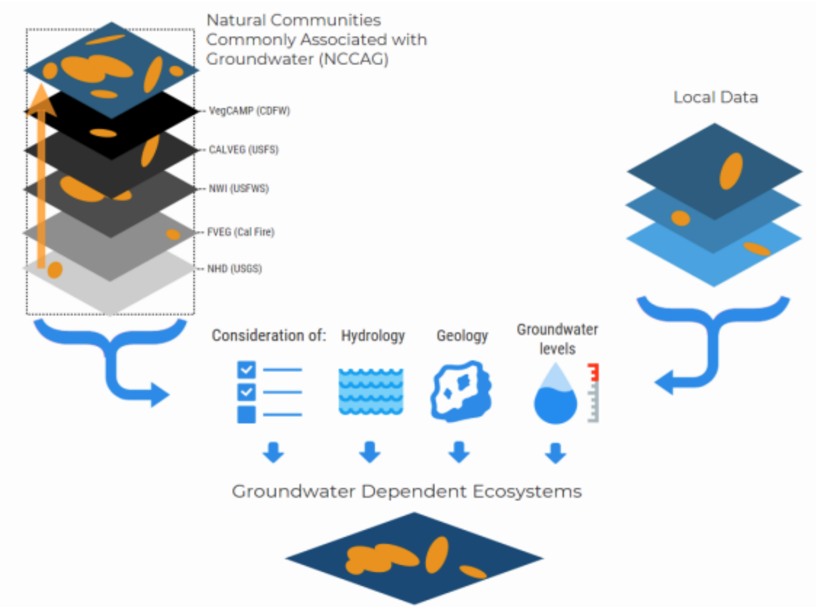


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

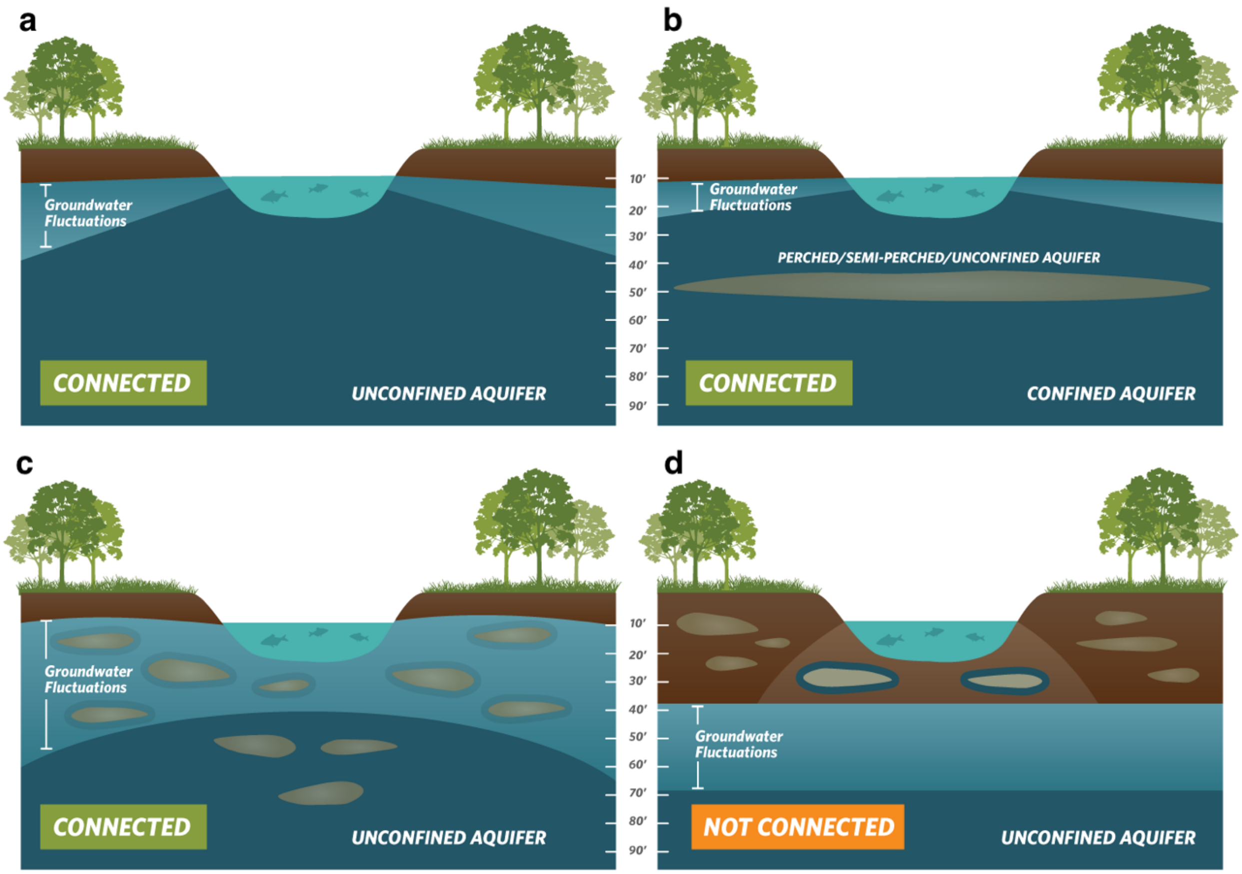

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

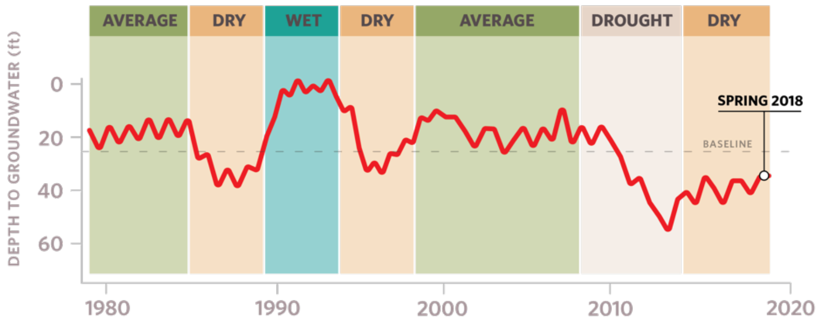

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

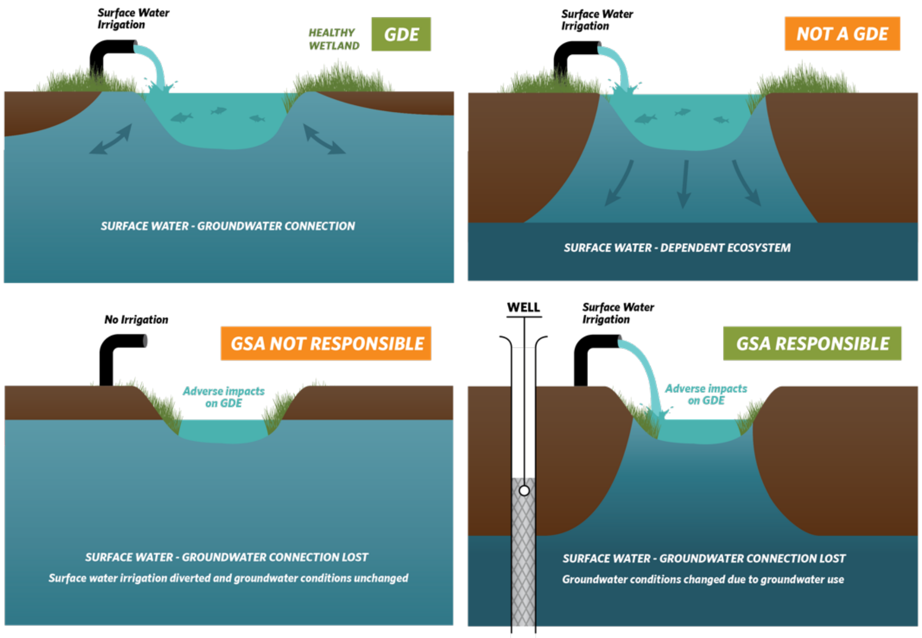

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

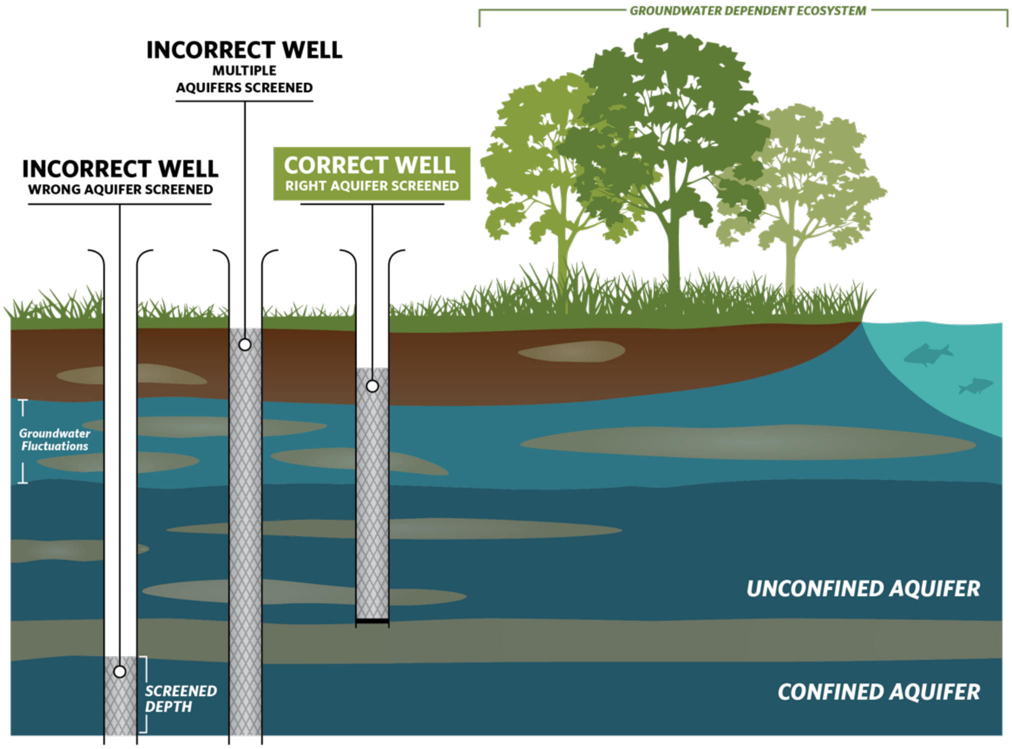

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

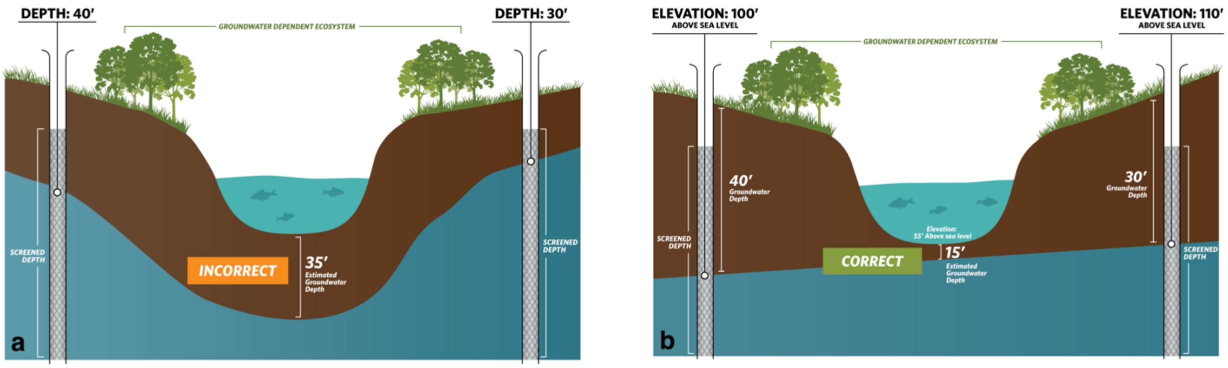

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

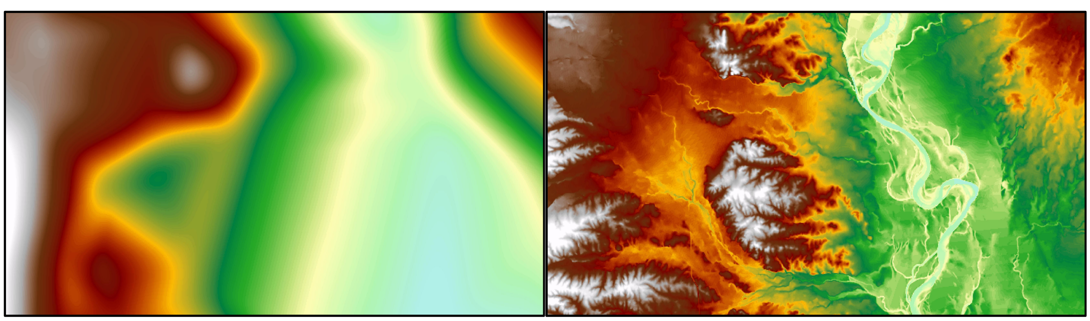

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment D

Maps of representative monitoring sites in relation to key beneficial users

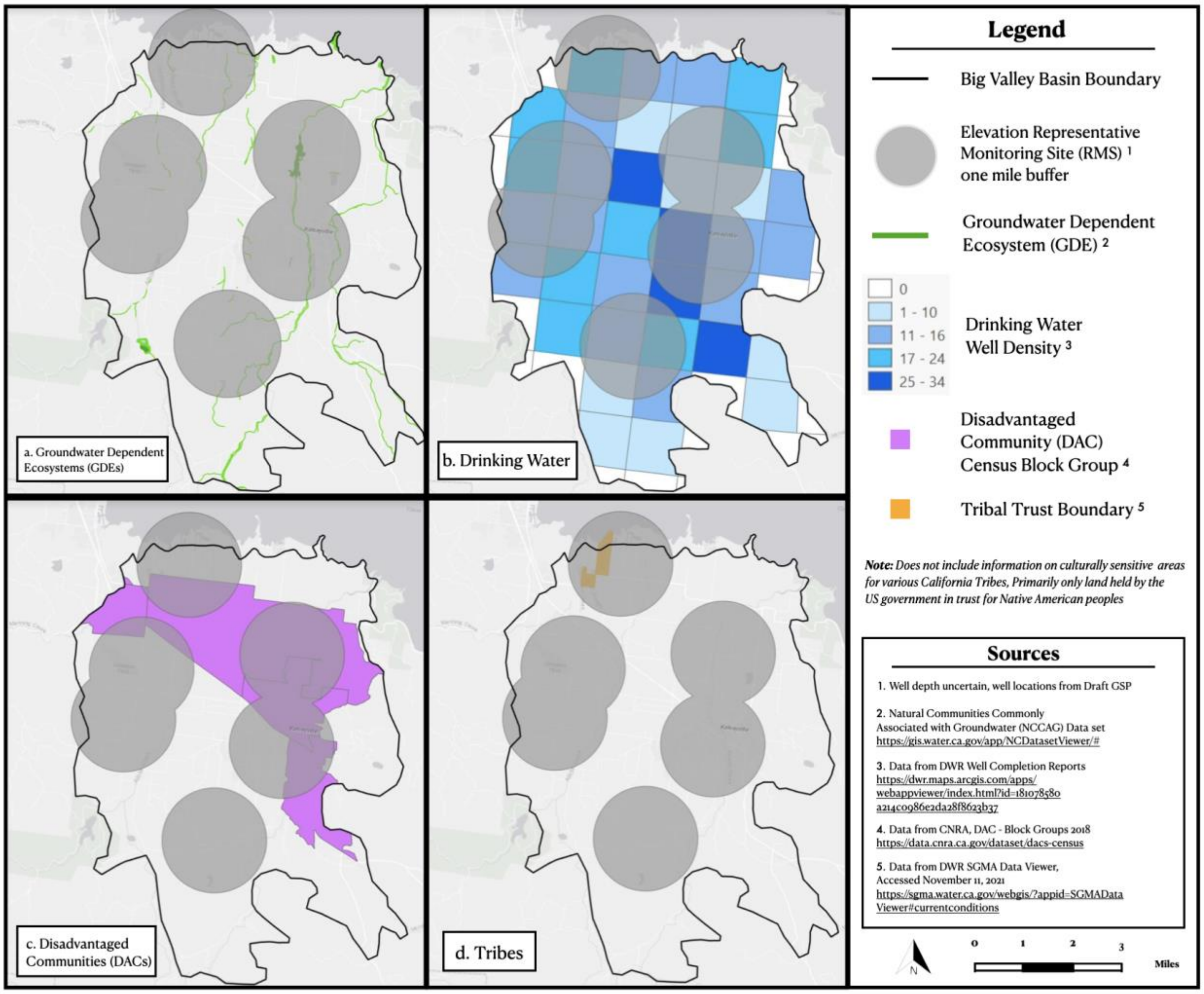

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

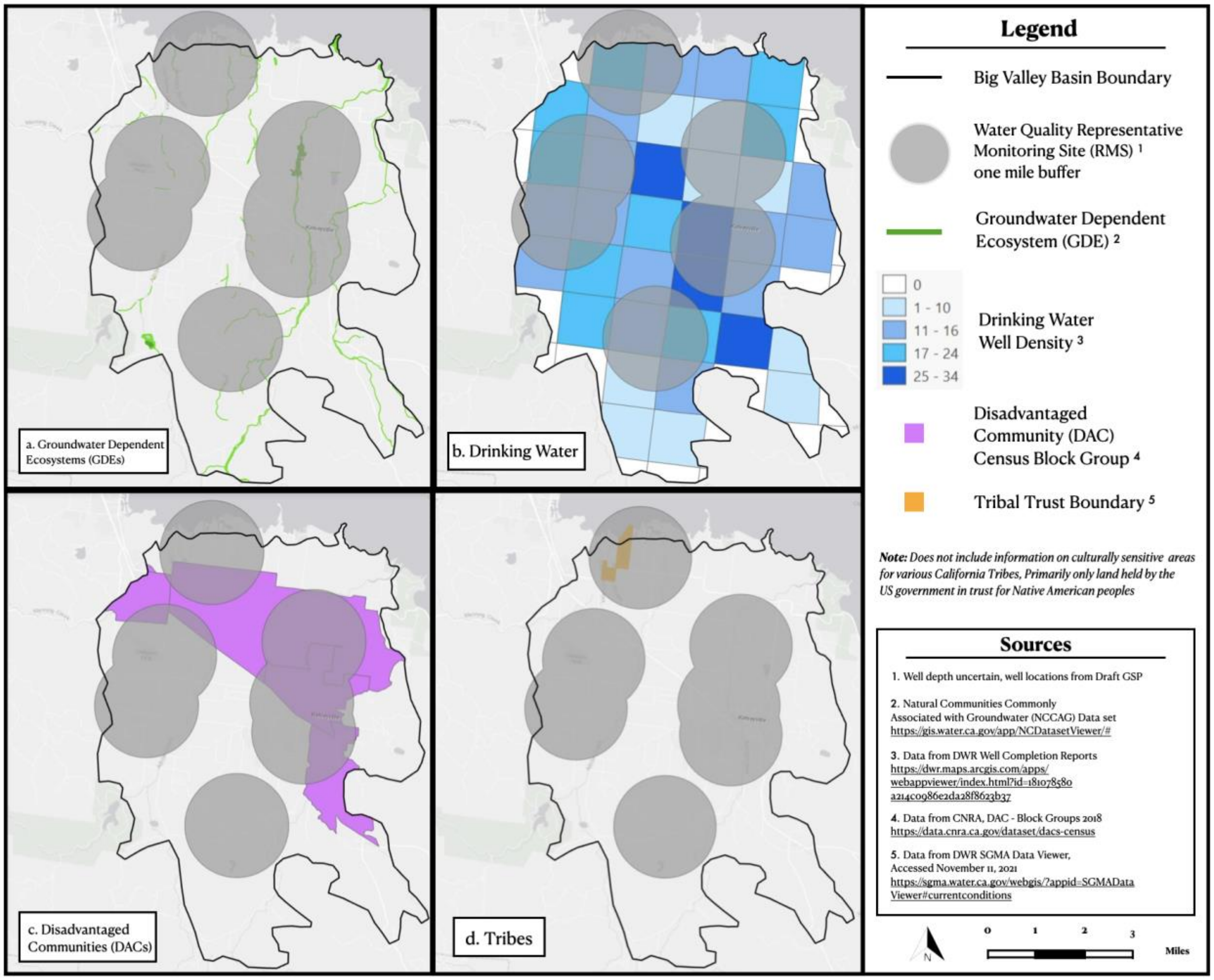

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

September 26, 2021

Siskiyou County Flood Control and Water Conservation District
1312 Fairlane Road
Yreka, CA 96097

Submitted via email: lauraf@lwa.com; katie.duncan@stantec.com; sgma@co.siskiyou.ca.us

Re: Public Comment Letter for Butte Valley Draft Groundwater Sustainability Plan

Dear Laura Foglia,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Butte Valley Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Butte Valley Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Butte Valley Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes
The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. We note the following deficiencies with the identification of these key beneficial users.

- The GSP states that there are three Severely Disadvantaged Communities (SDACs) in the basin, but these areas are not mapped.
- The GSP provides a map of domestic well density in Figure 1.5, but fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the basin.
- The GSP fails to identify the population dependent on groundwater as their source of drinking water in the basin. Specifics are not provided on how much each SDAC community relies on a particular water supply (e.g., what percentage is supplied by groundwater).

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS
• Provide a map of the SDACs in the basin. The DWR DAC mapping tool[1] can be used for this purpose. • The statement on p. 2-11 that there are no DACs in the basin is confusing, since SDACs are a subset of DACs. Please remove or clarify this sentence. • Include a map showing domestic well locations and average well depth across the basin.

[1] The DWR DAC mapping tool is available online at: https://gis.water.ca.gov/app/dacs/

- Identify the sources of drinking water for SDAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

- Describe the occurrence of tribal lands in the basin. If tribes have interests in the basin or if groundwater management within Butte Valley Basin will have impacts on downstream tribes, describe them in detail.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**. There is no map presented in the ISW section (Section 2.2.2.6) of stream reaches in the basin. The GSP provides a vague assessment of groundwater levels in the vicinity of stream reaches, with no specific details provided. The analysis concludes with the statement (p. 89): "Until the associated data gaps are addressed, Butte Creek is tentatively assumed disconnected from the Basin groundwater aquifer due to nearby deep groundwater levels."

The GSP acknowledges large data gaps for the determination of ISWs. However, given the gaps in groundwater level data and streamflow data, the stream reaches should be considered potential ISWs until further data can be gathered. Because the potential ISWs have not been identified, they cannot be adequately managed in the GSP. Until a disconnection can be proven, all potential ISWs should be included in the GSP. This is necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water.

RECOMMENDATIONS

- Provide a map showing all the stream reaches in the basin, with reaches clearly labeled with stream name and interconnected or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.

- Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

- Use seasonal data over multiple water year types (we recommend 10 years from 2005 to 2015) to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs.

- Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP. Data gaps are discussed in general terms in the ISW section (Section 2.2.2.6), but very little detail is provided.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to lack of clarity around the monitoring well data (well location and screen depth) used to map groundwater elevations and depth to groundwater. The GSP references TNC Best Practices for using the NC Dataset (2019) as the approach used to map depth to groundwater, using the difference between land surface elevation and interpolated groundwater elevation above mean sea level. However, the GSP does not further describe the monitoring well data (well location and screen depth) used to create the depth-to-groundwater maps.

The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources. However, we found that some mapped features in the NC dataset were improperly disregarded, as described below.

- NC dataset polygons were incorrectly removed in areas adjacent to irrigated fields due to the presence of surface water. However, this removal criteria is flawed since GDEs, in addition to groundwater, can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields – simultaneously and at different temporal/spatial scales. NC dataset polygons adjacent to irrigated land can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to irrigated fields.

- NC dataset polygons were incorrectly removed based on the amount of time that they access groundwater. As presented in the GSP, assumed GDEs have access to groundwater >50% of time and assumed non-GDEs have access to groundwater <50% of the time. However, NC dataset polygons should not be assumed to be disconnected if there is any connection to groundwater (regardless of temporal percentage). Many GDEs often simultaneously rely on multiple sources of water (i.e., both groundwater and surface water), or shift their reliance on different sources on an interannual or inter-seasonal basis.

RECOMMENDATIONS

- On the depth-to-groundwater level maps presented in Appendix 2-C, include the location of groundwater monitoring wells used to produce the maps. Discuss screening depth of monitoring wells and ensure they are monitoring the shallow principal aquifer.

- Use depth-to-groundwater data from multiple seasons and water year types to verify whether polygons in the NC Dataset are supported by groundwater, instead of the incorrect criteria mentioned above (presence of irrigation water or less than 50% time connected to groundwater).

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30 feet threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as “Potential GDEs” in the GSP until data gaps are reconciled in the monitoring network.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[2,3] to be included into the water budget. The integration of native vegetation and managed wetlands into the water budget is **insufficient**, due to the absence of Appendix 2-D (Water Budget). We could not determine if the water budget included the current, historical, and projected demands of native vegetation and managed wetlands. The inclusion of explicit water demands for native vegetation and managed wetlands is crucial, so that key environmental uses of groundwater are accounted for as water supply decisions are made using this budget and considered in project and management actions.

RECOMMENDATION

- Include Appendix 2-D (Water Budget) in the GSP. Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation and managed wetlands.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA’s requirement for public notice and engagement of stakeholders[4] is not fully met by the description in the Stakeholder Communication and Engagement Plan included in the GSP (Appendix 1-A).

The GSP describes outreach to tribal and environmental stakeholders in the basin and states that members of these groups are on the Stakeholder Advisory Committee. However, we note the following deficiencies with other aspects of the stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms. They include attendance at public meetings, stakeholder email list, and updates to

[2] “’Water use sector’ refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation.” [23 CCR §351(al)]
[3] “The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.” [23 CCR §354.18]
[4] “A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin.” [23 CCR §354.10(d)(3)]

the GSP website. There is no specific outreach described for members of the SDAC communities or domestic well owners.

- The Stakeholder Communication and Engagement Plan does not include a plan for continual opportunities for engagement through the *implementation* phase of the GSP for SDACs, domestic well owners, and environmental stakeholders.

RECOMMENDATION
• In the Stakeholder Communication and Engagement Plan, describe active and targeted outreach to engage SDAC members, domestic well owners, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[5] and establishing minimum thresholds.[6,7]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP does not sufficiently describe or analyze direct or indirect impacts on domestic drinking water wells, DACs, or tribes when defining undesirable results. The GSP does not sufficiently describe how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results in the basin. The GSP states (p. 3-34): “The minimum threshold is expected to cause as much as 15% well outages.” This is the only quantitative statement made however, and it is not supported by data or analysis.

For degraded water quality, minimum thresholds for the following three constituents of concern (COCs) are set at the maximum contaminant levels (MCLs): nitrate, specific conductivity and arsenic. However, the GSP does not set SMC for the other COCs in the basin (boron, benzene, and 1,2-dibromoethane). The GSP states on p. 3-37 that because 1,2-dibromoethane and benzene are already being monitored and managed by the Regional Board through the Leaking Underground Storage Tank (LUST) program, SMC are not needed. The GSP states that since boron is naturally occurring, SMC are not needed. However, SMC should be established for all COCs in the basin, in addition to coordinating with water quality regulatory programs. Naturally occurring COCs can be exacerbated as a result of groundwater use or groundwater management within the basin.

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[5] “The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.” [23 CCR §354.26(b)(3)]
[6] “The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.” [23 CCR §354.28(b)(4)]
[7] “The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference.” [23 CCR §354.28(b)(5)]

The GSP only includes a very general discussion of indirect impacts to drinking water users when defining undesirable results and evaluating the cumulative or indirect impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs or tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs or tribes.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users, DACs and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[8]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.

- Set minimum thresholds and measurable objectives for boron, benzene and 1,2-dibromoethane. Ensure they align with drinking water standards[9].

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater or surface water when defining undesirable results. This is problematic because without identifying potential impacts to GDEs and beneficial users of interconnected surface waters, minimum thresholds may compromise, or even destroy, environmental beneficial users. Since GDEs are present in the basin, they must be considered when developing SMC for the basin.

The GSP states that the depletion of interconnected surface water sustainability indicator is not applicable in the Basin, but this has not been proven. Chapter 2 of the GSP disregards ISWs due to data gaps. However, they should be retained as potential ISWs and preliminary SMC for the depletion of interconnected surface water sustainability indicator should be established.

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[8] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[9] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

RECOMMENDATIONS
● When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[10] in the basin. Defining undesirable results is the crucial first step before the minimum thresholds[11] can be determined. ● Establish preliminary SMC for the depletion of interconnected surface water sustainability indicator, that can be refined when data gaps are filled. When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when defining minimum thresholds in the basin[12]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,13].

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[14] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **incomplete**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2030 and 2070. The GSP also considers multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP includes climate change into key inputs (e.g., precipitation, evaporation, and surface water flow) of the projected water budget. However, we are

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[10] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[11] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[12] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[13] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[14] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

concerned that the selected period is from 1991-2011 and therefore it does not include the drought from 2012-2016. We look forward to reading Appendix 2-D (Water Budget) in the next draft of the GSP to learn about how you are integrating drought risk in your future water budget.

The GSP does not calculate a sustainable yield based on the projected water budget with climate change incorporated, but instead states that the sustainable yield will vary over time as new project and management actions are added. The GSP states (p. 2-126): "The sustainable yield is not a number that is constant over time, as future conditions may decrease or increase the amount of groundwater that can be withdrawn without causing undesirable results" and continues: "For every implementation of a PMA resulting in the reduction in groundwater pumping, including some conservation easements, there is a commensurate downward adjustment in sustainable yield. The exact amount of that adjustment varies over time and will depend on the future portfolio of PMAs implemented (see chapters 3 and 4). Without the automatic adjustment of the sustainable yield to future agreed-upon reductions in groundwater pumping, other water users in the Basin may claim that the reduction in groundwater pumping, e.g., for in lieu recharge, makes groundwater available for pumping elsewhere or at other times, up to the (constant) limit of the sustainable yield. This must be avoided to successfully manage the basin." Keep in mind that sustainable yield is a legally required component of SGMA and necessary for informing what project and management actions are necessary in the basin. If sustainable yield is not calculated, then there is also increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not explicitly calculate sustainable yield may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, domestic well owners, and tribes.

RECOMMENDATIONS

- Include Appendix 2-D (Water Budget) in the next draft of the GSP, so that the manner in which climate change is incorporated into the water budgets is fully explained.
- Estimate sustainable yield based on the projected water budget with climate change incorporated, to inform the basis for development of projects and management actions.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, GDEs, and ISWs. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[15].

The GSP includes a data gap assessment (Appendix 3-A) that identifies and prioritizes data gaps in the monitoring networks. Thus while the GSP recognizes the importance of filling data gaps, it does not provide specific plans, well locations shown on a map, or a timeline to fill the data gaps. The GSP states (p. 3-6): "These additional monitoring or information requirements depend on future availability of funding

[15] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

and are not yet considered among the GSP Representative Monitoring Points (RMPs). They will be considered as potential RMPs and may eventually become part of the GSP network at the 5-year GSP update." However, the additional RMPs should be included in the GSP now, instead of included in the 5-year GSP update. Without a map of proposed new monitoring well locations, a determination cannot be made regarding the adequacy of the monitoring network for sustainability indicators going forward into the GSP implementation phase.

RECOMMENDATIONS
• Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, GDEs, and ISWs to clearly identify potentially impacted areas. Increase the number of representative monitoring points (RMPs) across the basin as needed to adequately monitor all groundwater condition indicators. Prioritize proximity to GDEs and drinking water users when identifying new RMPs. • Provide specific plans to fill data gaps in the monitoring network. Evaluate how the gathered data will be used to identify and map GDEs and ISWs, and identify DACs and shallow domestic well users that are vulnerable to undesirable results. • Further describe the biological monitoring that will be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the basin. Section 4.4 mentions the use of satellite images to evaluate the status of GDEs, however no further details are provided in the GSP.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to beneficial users of groundwater such as DACs and drinking water users.

We commend the GSA for including projects and management actions with explicit benefits to the environment (e.g., the Abandonment of Sam's Neck Flood Control Facility and Kegg Meadow Enhancement and Butte Creek Channel Restoration). The GSP discusses how these projects will benefit ecosystems, but does not discuss the manner in which DACs, drinking water users, and tribes may be benefitted or impacted by projects and management actions identified in the GSP. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

RECOMMENDATIONS
• For DACs and domestic well owners, include further discussion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. The GSP describes a well replacement program in Section 4.3 (Tier II PMAs), but no details are provided. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs, domestic well owners, and tribes, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[16].

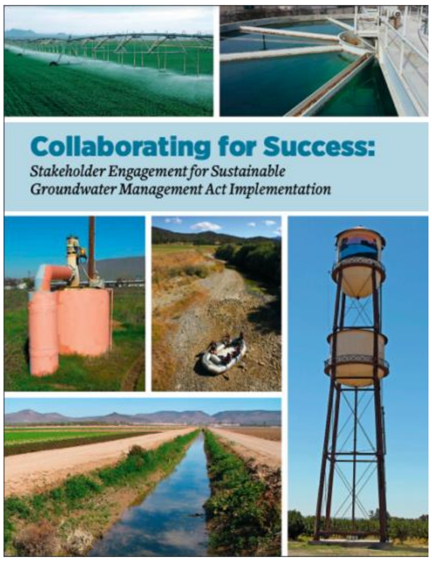
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[16] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

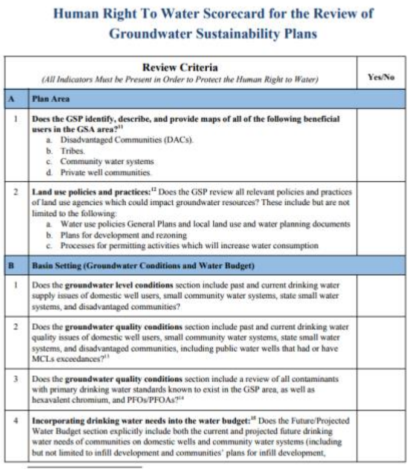
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

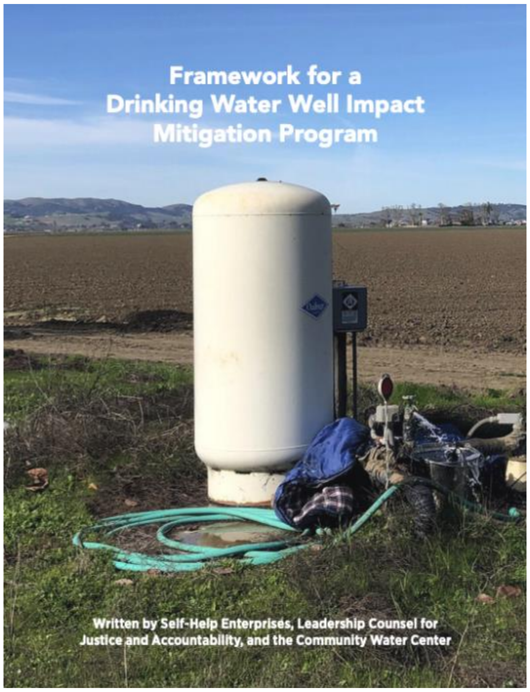


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

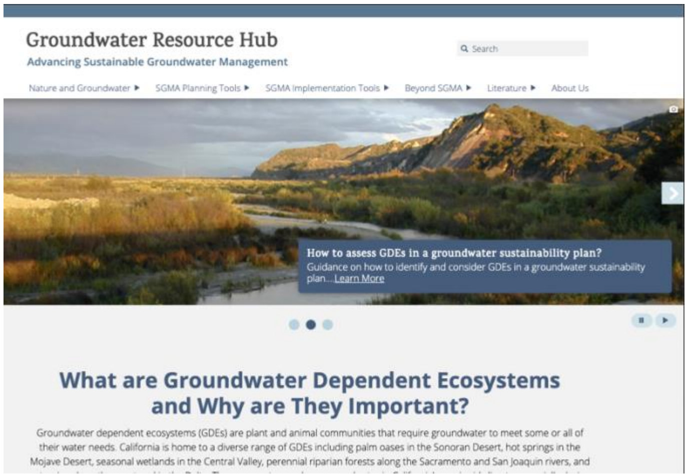
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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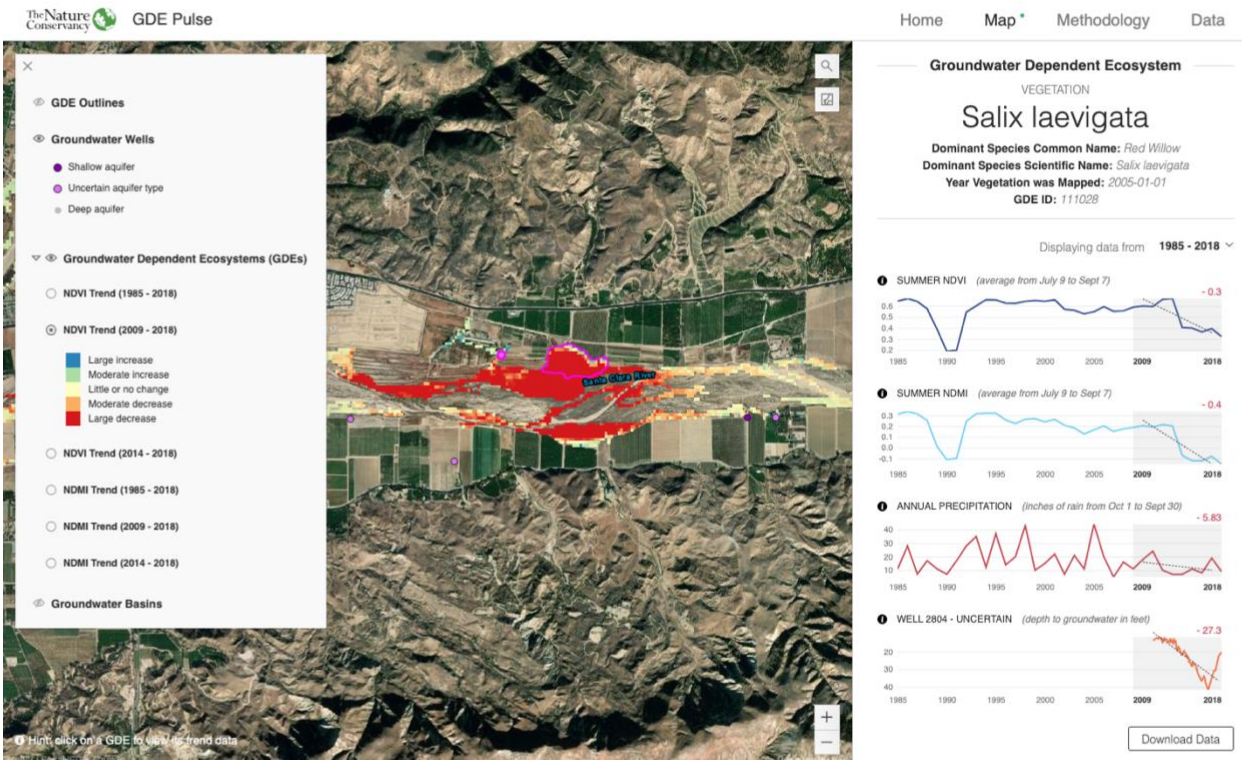
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

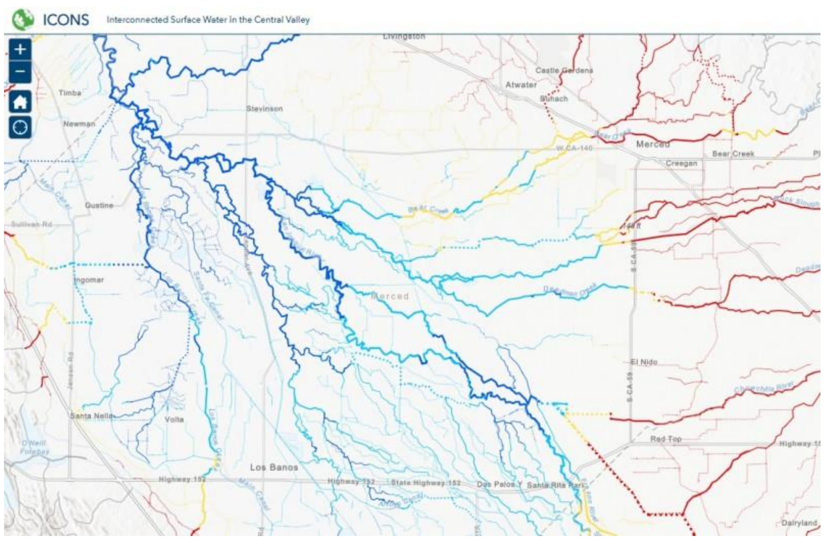
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Butte Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Butte Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya valisineria	Canvasback		Special	

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Limnodromus scolopaceus	Long-billed Dowitcher			
Megaceryle alcyon	Belted Kingfisher			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority

CRUSTACEANS				
Hyalella muerta	An Amphipod		Special	
Hyalella spp.	Hyalella spp.			
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus punctatus	Red-spotted Toad			
Pseudacris regilla	Northern Pacific Chorus Frog			
Rana pretiosa	Oregon Spotted Frog	Proposed Threatened	Special Concern	ARSSC
Spea intermontana	Great Basin Spadefoot			ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Ablabesmyia spp.	Ablabesmyia spp.			
Aeshna spp.	Aeshna spp.			
Antocha spp.	Antocha spp.			
Apedilum spp.	Apedilum spp.			
Argia spp.	Argia spp.			
Atractelmis wawona	Wawona Riffle Beetle		Special	
Callibaetis spp.	Callibaetis spp.			
Cenocorixa wileyae				Not on any status lists
Centroptilum spp.	Centroptilum spp.			
Chironomidae fam.	Chironomidae fam.			
Cleptelmis addenda				Not on any status lists
Clinotanypus spp.	Clinotanypus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corisella decolor				Not on any status lists
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Cryptotendipes spp.	Cryptotendipes spp.			
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Gumaga spp.	Gumaga spp.			
Haliplus spp.	Haliplus spp.			
Helicopsyche spp.	Helicopsyche spp.			
Hesperocorixa laevigata				Not on any status lists
Hydroptila arctia	A Caddisfly			

Hydroptila spp.	Hydroptila spp.			
Laccophilus maculosus				Not on any status lists
Liodessus obscurellus				Not on any status lists
Microtendipes spp.	Microtendipes spp.			
Mideopsis spp.	Mideopsis spp.			
Notonecta kirbyi				Not on any status lists
Oecetis spp.	Oecetis spp.			
Ophiogomphus spp.	Ophiogomphus spp.			
Optioservus spp.	Optioservus spp.			
Oxyethira spp.	Oxyethira spp.			
Parakiefferiella spp.	Parakiefferiella spp.			
Paralauterborniella spp.	Paralauterborniella spp.			
Paraleptophlebia spp.	Paraleptophlebia spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Pentaneura spp.	Pentaneura spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Procladius spp.	Procladius spp.			
Procloeon venosum	A Mayfly			
Psectrocladius spp.	Psectrocladius spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Radotanypus spp.	Radotanypus spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Sanfilippodytes spp.	Sanfilippodytes spp.			
Sialis spp.	Sialis spp.			
Simulium spp.	Simulium spp.			
Tanytarsus spp.	Tanytarsus spp.			
Tricorythodes spp.	Tricorythodes spp.			
Wormaldia spp.	Wormaldia spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
Sorex palustris	American Water Shrew			Not on any status lists
MOLLUSKS				
Gyraulus spp.	Gyraulus spp.			
Lymnaea spp.	Lymnaea spp.			
Physa spp.	Physa spp.			

Pisidium spp.	Pisidium spp.			
PLANTS				
Potentilla newberryi	Newberry's Cinquefoil		Special	CRPR - 2B.3
Rorippa columbiae	Columbia Yellowcress		Special	CRPR - 1B.2
Alopecurus aequalis aequalis	Short-awn Foxtail			
Amphiscirpus nevadensis				Not on any status lists
Anemopsis californica	Yerba Mansa			
Aquilegia shockleyi	NA			Not on any status lists
Bistorta bistortoides				Not on any status lists
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Carex alma	Sturdy Sedge			
Carex densa	Dense Sedge			
Carex nebrascensis	Nebraska Sedge			
Damasonium californicum				Not on any status lists
Downingia bacigalupii	Bacigalup's Downingia			
Downingia cuspidata	Toothed Calicoflower			
Downingia insignis	Parti-color Downingia			
Downingia pulcherrima				Not on any status lists
Downingia yina	NA			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis bella	Delicate Spikerush			
Eleocharis coloradoensis				Not on any status lists
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Eleocharis parishii	Parish's Spikerush			
Eleocharis rostellata	Beaked Spikerush			
Epipactis gigantea	Giant Helleborine			
Fimbristylis thermalis	Hot Springs Fimbry		Special	CRPR - 2B.2
Iris missouriensis	Western Blue Iris			
Juncus xiphioides	Iris-leaf Rush			
Lobelia cardinalis cardinalis	NA			
Lythrum californicum	California Loosestrife			

Montia chamissoi	Chamisso's Miner's-lettuce			
Myosurus apetalus	Bristly Mousetail			
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Myriophyllum aquaticum	NA			
Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Navarretia leucocephala minima	Least Navarretia			
Paspalum distichum	Joint Paspalum			
Phacelia distans	NA			
Phragmites australis australis	Common Reed			
Pluchea sericea	Arrow-weed			
Psilocarphus oregonus	Oregon Woolly-heads			
Puccinellia nuttalliana	Nuttall's Alkali Grass			
Rhododendron columbianum				Not on any status lists
Rumex salicifolius salicifolius	Willow Dock			
Salix exigua exigua	Narrowleaf Willow			
Salix exigua hindsiana				Not on any status lists
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Schoenoplectus americanus	Three-square Bulrush			
Schoenoplectus pungens longispicatus	Three-square Bulrush			
Scirpus microcarpus	Small-fruit Bulrush			
Senecio hydrophilus	Great Swamp Ragwort			
Sidalcea pedata	Pedate Checker-mallow	Endangered	Endangered	CRPR - 1B.1
Stachys albens	White-stem Hedge-nettle			
Stuckenia striata				Not on any status lists
Symphyotrichum frondosum	Alkali Aster			
Symphyotrichum lanceolatum lanceolatum	NA			
Typha domingensis	Southern Cattail			

Veronica anagallis-aquatica	NA			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

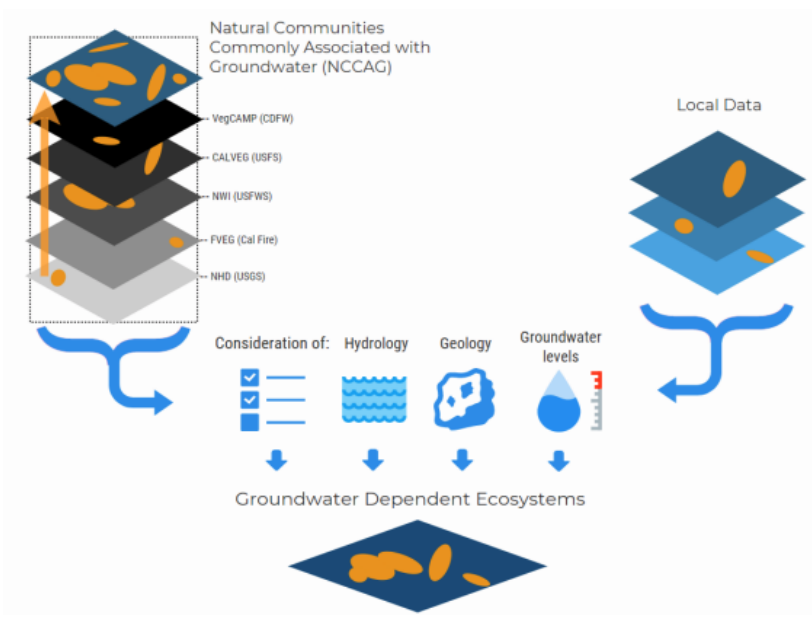


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

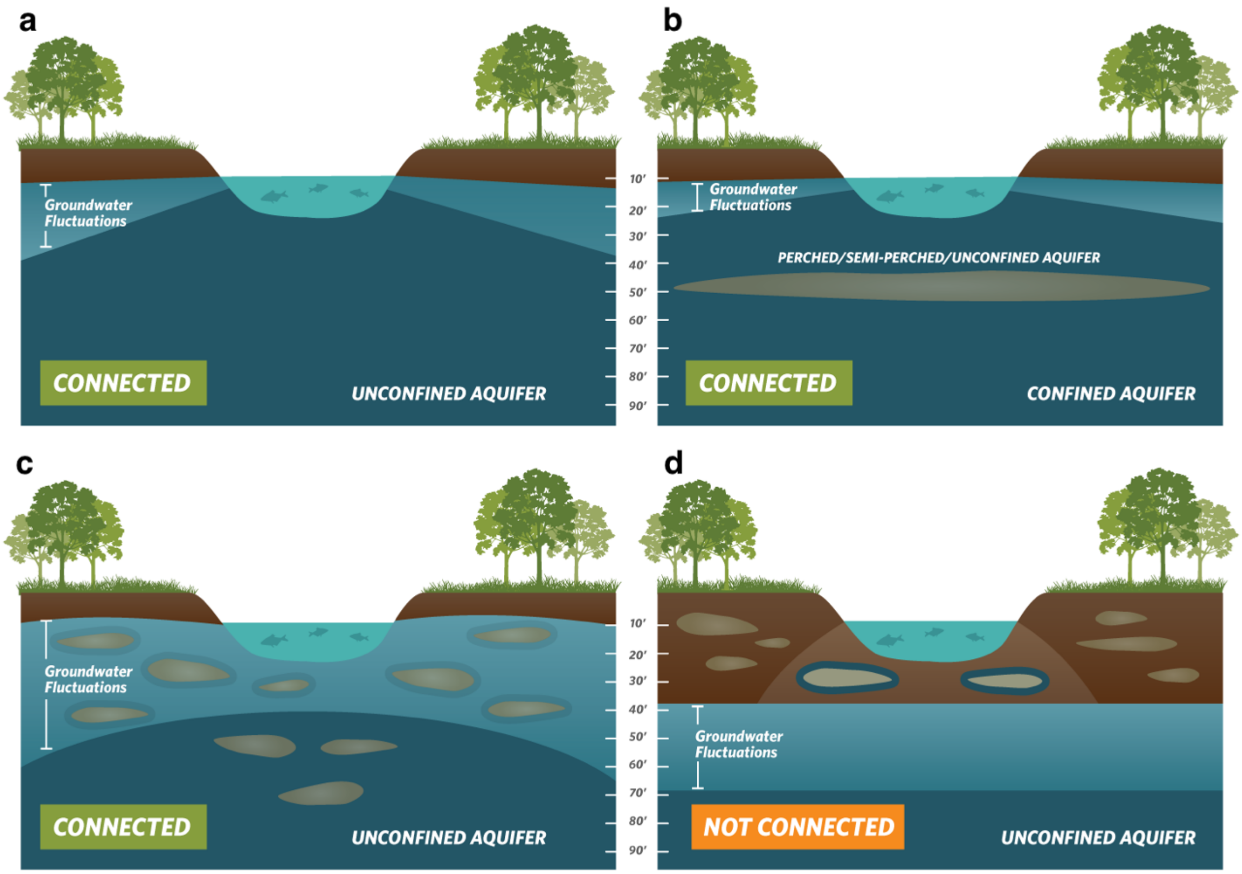

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

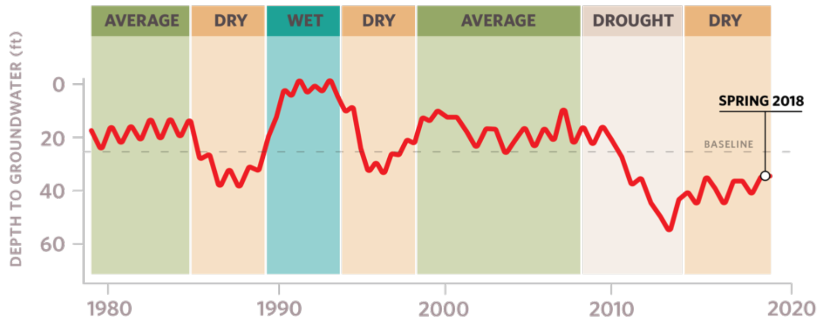

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

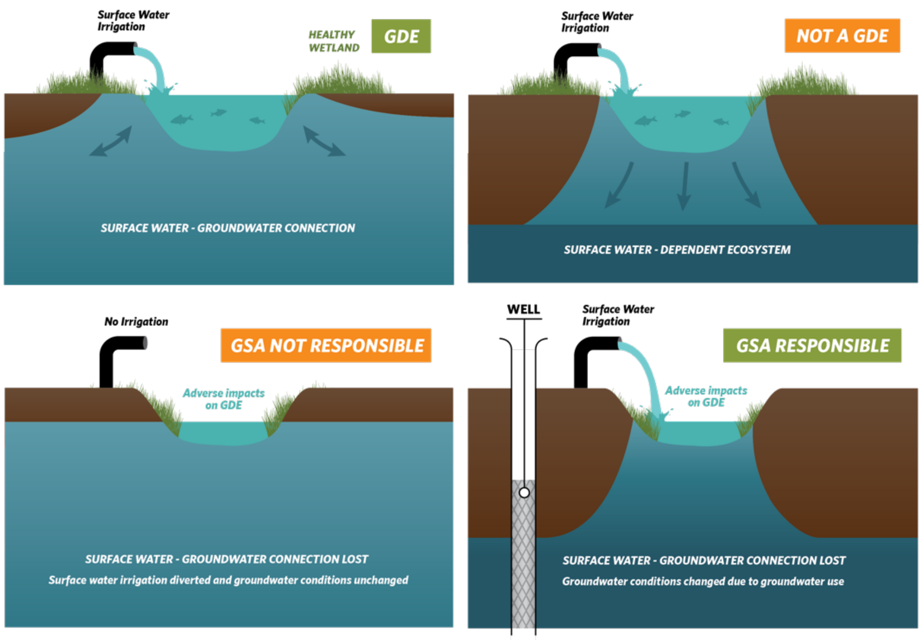

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

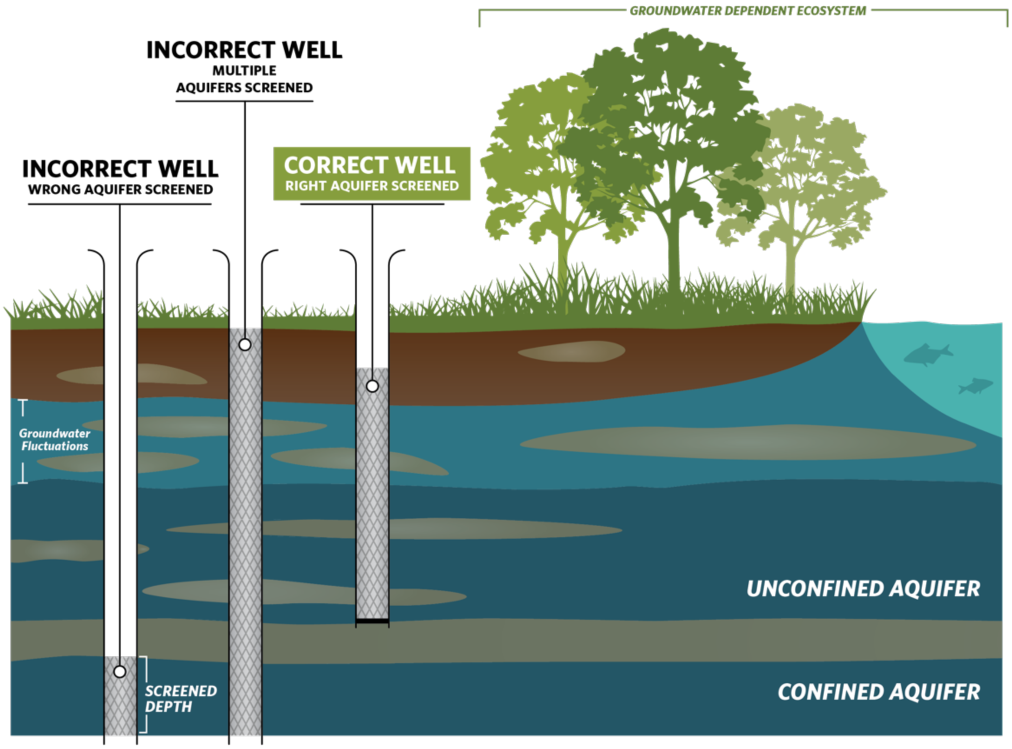

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

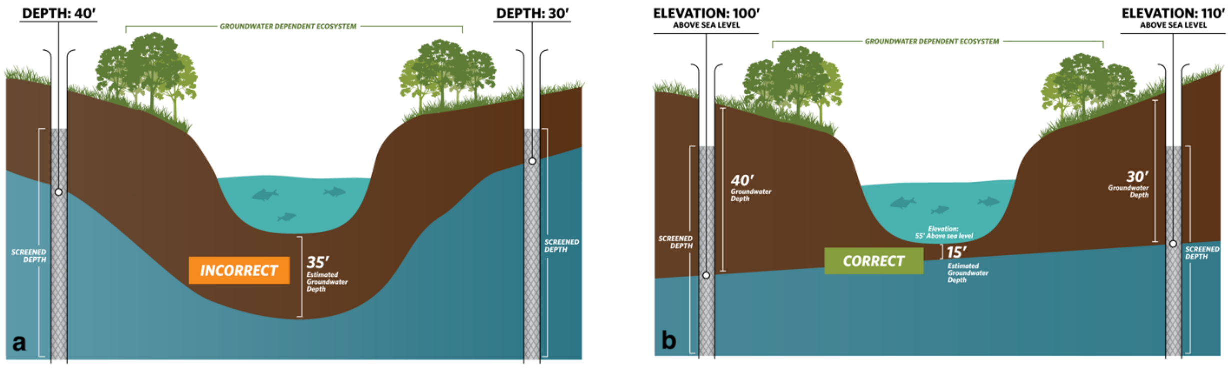

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

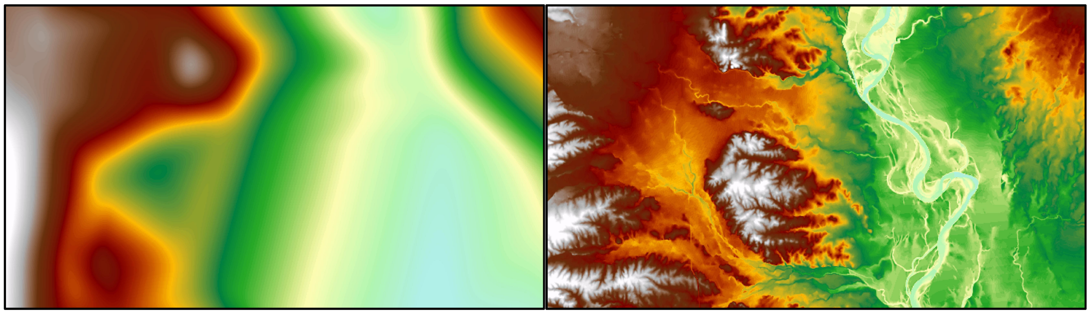

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

October 31, 2021

Butte Subbasin GSAs
308 Nelson Ave
Oroville, CA 95965

Submitted via email: info@buttebasingroundwater.org

Re: Public Comment Letter for Butte Subbasin Draft GSP

Dear Anjanette Shadley,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Butte Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Butte Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

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Attachment A

Specific Comments on the Butte Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. The GSP references Appendix 5.A.2 (Analysis of Disadvantaged Communities in the Plan Area), but states that it is still in development at the time of Draft GSP publication.

As this Appendix is finalized, we provide our recommendations for the identification of these key beneficial users below. These elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide a map of the boundaries of the recognized DACs in the subbasin. Provide the population of each identified DAC. Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). • Include a domestic well density map for the subbasin. • Include a map showing domestic well locations and well depth (such as minimum well depth, average well depth, or depth range) across the subbasin. Figure 4-2 provides a point location map of all wells within the subbasin, but groups all wells together and does not differentiate between well types.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **incomplete**. The GSP describes the use of the BBGM (Butte Basin Groundwater Model) to analyze the interaction between groundwater and surface water within the subbasin. The GSP could be improved by including

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

further description of the data used in the model. This information should include groundwater level monitoring well data and stream gauge data that were incorporated into the model, the screening depths of wells used in the groundwater model, and description of the temporal (seasonal and interannual) variability of the data used to calibrate the model.

The GSP states (p. 2-51): *"Based on consideration of the frequency with which stream segments are gaining based on BBGM results and on consideration of the spring depth to groundwater below the estimated streambed depth along each primary stream, it is likely that all streams traversing or bounding the subbasin are connected to the groundwater system."* Figure 2-28 presents a map of stream reaches in the subbasin, showing the percentage of months of a gaining condition in the subbasin as predicted by the BBGM model. We recommend that the reaches are also labeled as interconnected, so that it is clear that all stream segments are retained as ISWs in the GSP.

RECOMMENDATIONS

- Label stream reaches on Figure 2-28 as interconnected, to make clear that all stream segments are retained as ISWs in the GSP.
- Further describe the groundwater elevation data, including well screen depth interval, and stream flow data used in the BBGM analysis.
- To confirm and illustrate the results of the groundwater modeling, overlay the stream reaches shown on Figure 2-28 with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis.
- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.
- Describe data gaps for the ISW analysis in the ISW section, in addition to the discussion in the sustainable management criteria section (4.4 Sustainable Management Criteria Data Gaps).

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. Description of the subbasin's GDEs is presented in Appendix 2.E (Assessment of Groundwater Dependent Ecosystems for the Butte Subbasin GSP). There is no callout or reference to the GDE Appendix in the main body of the GSP. Figures 1-4 as referenced in Appendix 2.E appear to be missing from the Appendix. The only map of the subbasin's GDEs appears in Figure 5-2 (Planned New Primary Aquifer Monitoring Sites for Monitoring Depletions of Interconnected Surface Water and GDEs).

The GSP Appendix does not discuss how the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) was verified with the use of groundwater data from the shallow aquifer. The GSP Appendix took initial steps to identify GDEs using the NC dataset and other sources. However, we found that some mapped features in the NC dataset were improperly disregarded. NC dataset polygons were incorrectly removed in areas adjacent to irrigated fields or due to the presence of surface water supplies. However, this removal criteria is flawed since GDEs, in addition to groundwater, can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields – simultaneously and at different temporal/spatial scales. NC dataset polygons adjacent to irrigated land or surface water supplies can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to irrigated fields or surface water.

The GSP did not discuss the flora or fauna species present in the subbasin's GDEs, except to acknowledge the presence of Valley Oak (*Quercus lobata*) in the subbasin. We commend the GSAs for retaining all Valley Oak polygons in the NC dataset based on the recognition that they can access groundwater at deeper depths.

RECOMMENDATIONS

- Reference the GDE Appendix 2.E in the main body of the GSP. Include the missing GDE figures.
- Ensure that the GDE figures provide a comprehensive set of maps for the subbasin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained, removed, or added to/from the NC dataset (include the removal reason if polygons are not considered potential GDEs, or include the data source if polygons are added). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.
- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.
- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.
- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network. It is not clear from the description in the GSP Appendix whether NC dataset polygons considered as 'Uncertain' or 'Not Likely a GDE' are retained as potential GDEs.
- Include an inventory of the fauna and flora present within the subbasin's GDEs (see Attachment C of this letter for a list of freshwater species located in the Butte Subbasin). Note any threatened or endangered species.

Native Vegetation and Managed Wetlands
Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of these ecosystems into the water budget is **sufficient** because the GSP included groundwater demands of native vegetation and managed wetlands in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP Development
Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Stakeholders Communication and Engagement Plan (Appendix 2.A.a).[4]

We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement for DACs, domestic well owners, and environmental stakeholders during the GSP development and implementation processes are described in very general terms. They include stakeholder briefings, attendance at public meetings, public workshops, public hearings, and public notices. There are no specific details provided regarding targeted outreach to DACs, domestic well owners, and environmental stakeholders.

- The Stakeholders Communication and Engagement Plan does not include specific plans for continual engagement during the GSP *implementation* phase with DACs, domestic well owners, and environmental stakeholders.

RECOMMENDATIONS
● Include a more detailed and robust Stakeholders Communication and Engagement Plan that describes active and targeted outreach to engage DAC members, domestic well owners, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. ● Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the basin within the GSP.[5]

[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]
[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]
[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]
[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP determines the minimum threshold as follows (p. 4-14): *"1. Determine the shallower of: a. The shallowest 7th percentile of nearby domestic wells b.The range of measured groundwater levels or 20 feet (whichever is greater) below the observed historic low 2. If the resulting value is shallower than the observed historic low, set the MT as 10 feet deeper than the observed historic low. Setting minimum thresholds using this process is protective of Beneficial Uses and Users of the primary aquifer, including agricultural, municipal, and domestic uses, because the minimum threshold is calculated to be at a level that allows for adequate flexibility for increased groundwater extractions during drought periods (e.g. 2015) while protecting at least 93% of nearby domestic wells that are less than 700 feet deep (the maximum depth of the primary aquifer representative monitoring network), therefore avoiding undesirable results."* Despite the statement that these minimum thresholds will protect 93% of domestic wells, the GSP does not sufficiently describe whether these minimum thresholds will avoid significant and unreasonable impacts to drinking water for the 7% of wells in the basin not protected by the minimum threshold and remain consistent with California's Human Right to Water policy,[9] especially in the absence of a well mitigation plan.

Furthermore, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs when defining undesirable results, nor does it describe how the existing minimum threshold for groundwater levels are consistent with Human Right to Water policy and avoiding undesirable results to DACs in the subbasin.

For degraded water quality, the GSP identifies salinity as the only constituent of concern (COC) for which SMC are developed. The GSP states (p. 4-25): *"A preliminary minimum threshold for salinity (measured as electrical conductivity or EC) was proposed for the Subbasin. The minimum threshold for electrical conductivity in water quality representative monitoring wells was set as the higher of 900 μS/cm or the measured historical high, whichever is greater."* Instead of allowing historical highs, instead we recommend that minimum thresholds remain below the upper secondary maximum contaminant level (SMCL) for EC of 1,600 μS/cm.

The GSP continues (p. 4-25): *"The GSAs will also consider setting minimum thresholds for other constituents as part of the 5-year update. The established minimum thresholds will take into consideration: Maximum Contamination Levels (MCL); Local conditions (historical measurements); Agricultural requirements (Irrigated Lands Regulatory Program [ILRP], Central Valley Salinity Alternatives for Long-Term Sustainability [CV-SALTS])."* However, SMC should be

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[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

established for all COCs in the subbasin impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

The GSP only includes a very general discussion of impacts to drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and drinking water users when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

Degraded Water Quality

- Describe direct and indirect impacts on DACS and drinking water users when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[10]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACS and drinking water users.

- Provide a table in the GSP that presents the minimum thresholds for EC. Ensure that the minimum thresholds remain below the upper SMCL of 1,600 µS/cm.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management. Ensure they align with drinking water standards.[11]

Groundwater Dependent Ecosystems and Interconnected Surface Waters

For chronic lowering of groundwater levels, sustainable management criteria do not consider impacts to GDEs. In Section 4.3.1.1 (Primary Aquifer Minimum Thresholds for Chronic Lowering of Groundwater Levels), the GSP states: *"GDEs will be monitored by a dedicated interconnected surface water depletion representative network since the existing groundwater level network is not suitable for GDE monitoring."* In the project and management action section of the GSP, Figure 5-2 (Planned New Primary Aquifer Monitoring Sites for Monitoring Depletions of Interconnected Surface Water and GDEs) shows data gap areas where additional monitoring for GDEs is proposed. However, the GSP should also describe how sustainable management criteria for chronic lowering of groundwater levels will be updated once the new monitoring for GDEs is in place.

[10] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[11] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

For depletion of interconnected surface waters, minimum thresholds were set at 10 feet below the measured historical low for each of the representative monitoring wells. The GSP states (p. 4-28): *"The minimum threshold was selected such that levels would be protective of the beneficial use of interconnected surface water and of shallower groundwater near streams and rivers, including those of shallower domestic users and potential groundwater dependent ecosystems. The additional 10 feet in depth below the measured historical low (during which no undesirable results were observed) is intended to provide an appropriate margin of operational flexibility during GSP implementation."* However, no analysis or discussion is presented to describe how the SMC will affect GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- Describe how chronic lowering of groundwater SMC directly for environmental beneficial users of groundwater will be developed when the monitoring network is updated. When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin.[12] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[13]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[14] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,15]

[12] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[13] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[14] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[15] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[16] The effects of climate change can intensify the impacts of water stress on GDEs, making available shallow groundwater resources more critical for their survival. Research shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[17] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the GSP does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

We acknowledge and commend the inclusion of climate change into key inputs (e.g., precipitation, evapotranspiration, and surface water flow) of the projected water budget. The sustainable yield is calculated based on the projected pumping with climate change incorporated. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS
• Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions. • Clarify whether imported water is included in surface water flow inputs in the projected water budget. • Incorporate climate change scenarios into projects and management actions.

[16] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[17] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs and domestic wells in the subbasin.

Figure 3-1 (Primary Aquifer Representative Groundwater Level Monitoring Network) and Figure 3-3 (Groundwater Quality Representative Monitoring Network) show that no monitoring wells are located across portions of the subbasin near DACs and domestic wells (see maps provided in Attachment E). Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[18]

Figure 5-2 (Planned New Primary Aquifer Monitoring Sites for Monitoring Depletions of Interconnected Surface Water and GDEs) shows proposed monitoring sites that cover the area of mapped GDEs. However, as our comments above in the GDE section state, because of missing figures in the GDE section, we are not able to confirm that proposed GDE monitoring is sufficient.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify which beneficial users are not adequately being monitored. Increase the number of RMSs in the shallow aquifer across the subbasin as needed to adequately monitor all groundwater condition indicators. Prioritize proximity to DACs, domestic wells, and GDEs when identifying new RMSs.
- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient** to the failure to completely identify potential impacts to water quality from proposed projects. Additionally, the GSP fails to specify explicit benefits from proposed project and management actions to DACs and drinking water users. Therefore, potential project and management actions as currently proposed may overlook the protection of beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

We commend the GSAs for describing the environmental benefits of the on-farm groundwater recharge program in the Butte Subbasin, as developed with support and guidelines from The Nature Conservancy (TNC). The program is based on the TNC's multi-benefit recharge program.

[18] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

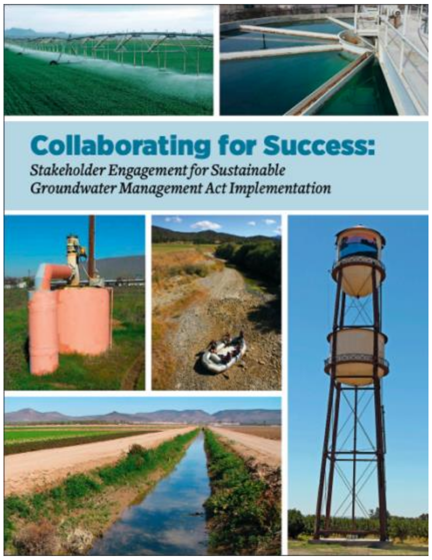
- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSAs plans to mitigate such impacts.

- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



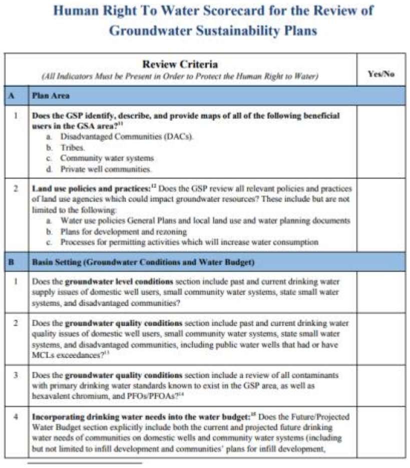
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

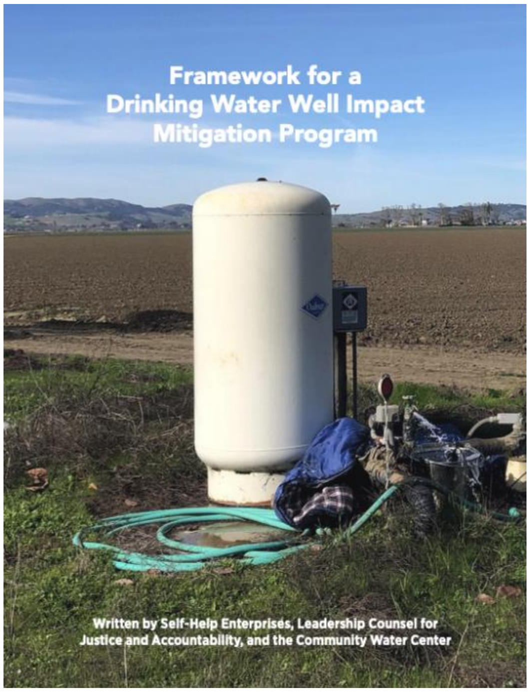


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

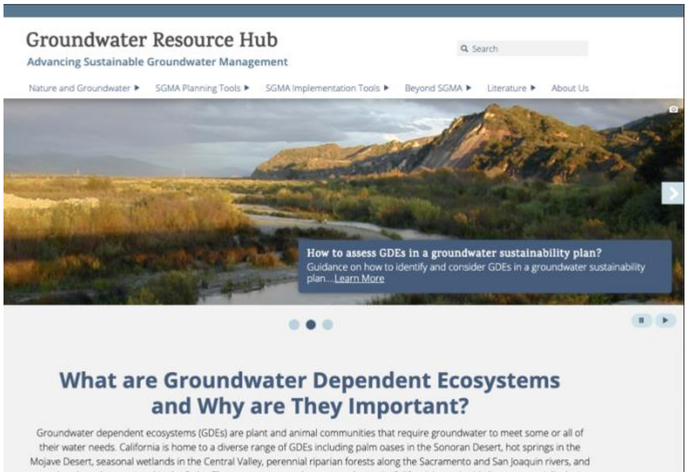
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



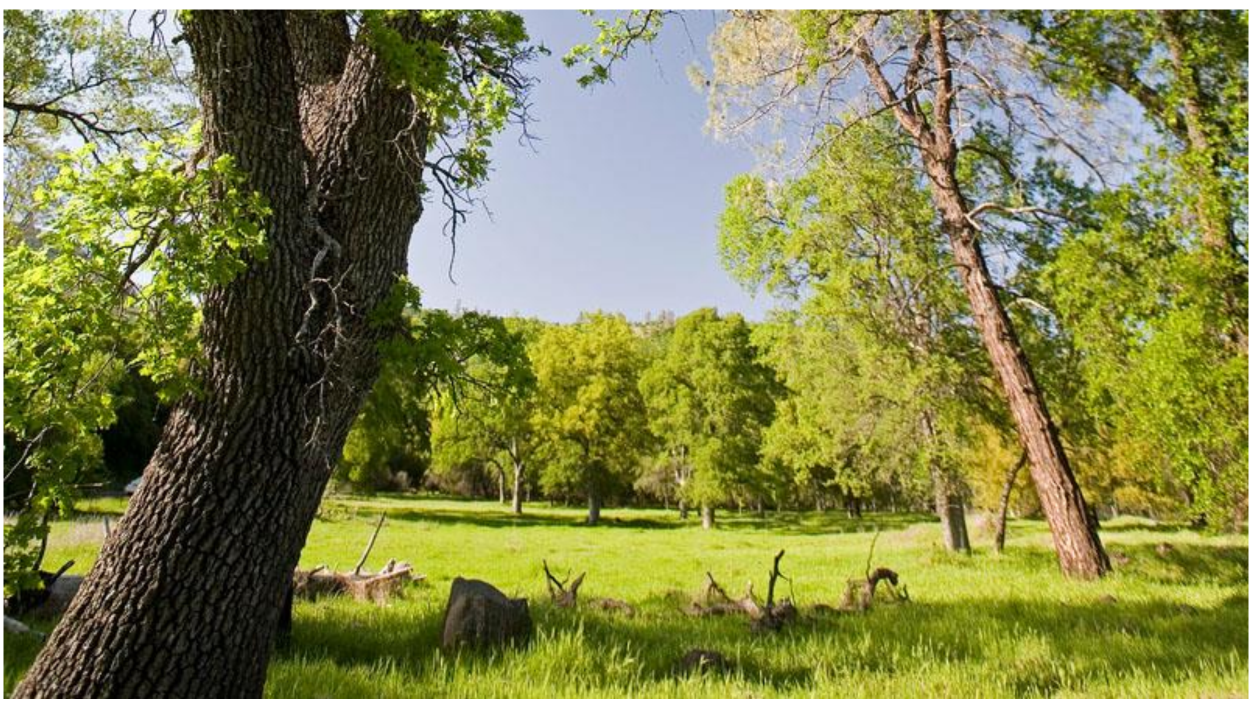
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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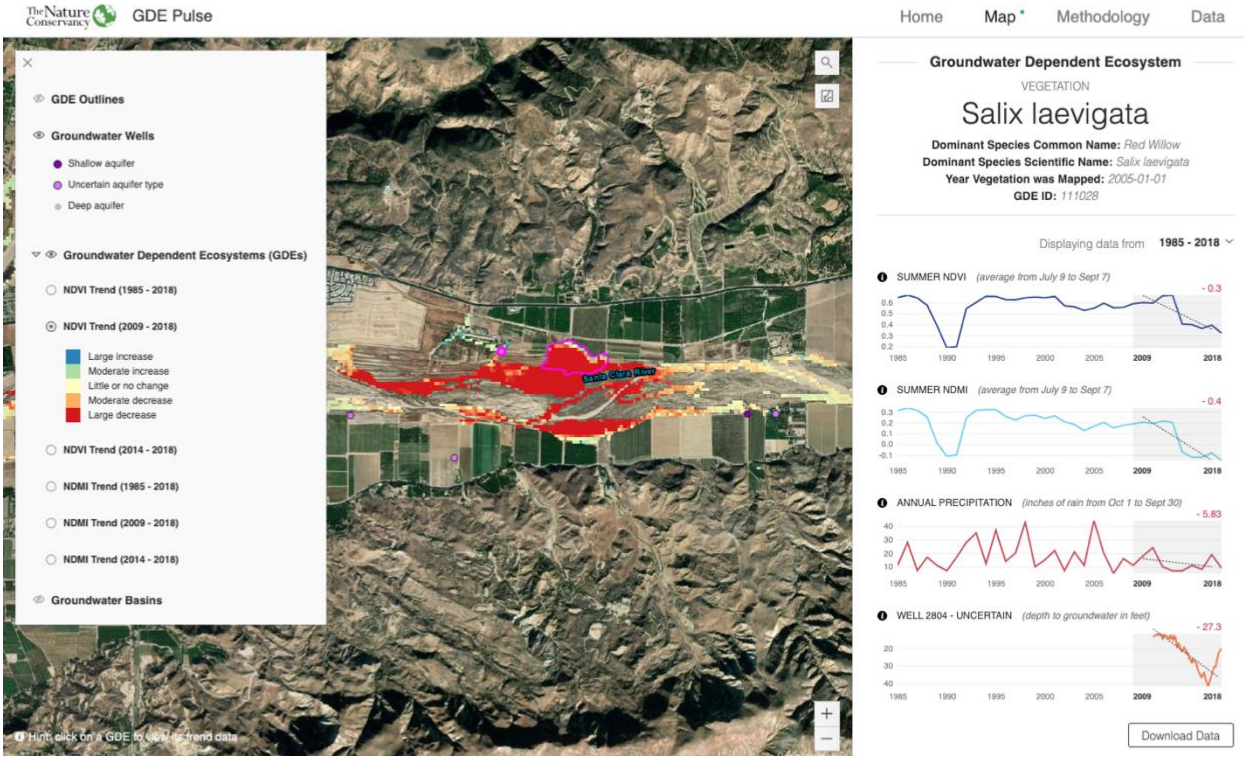
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

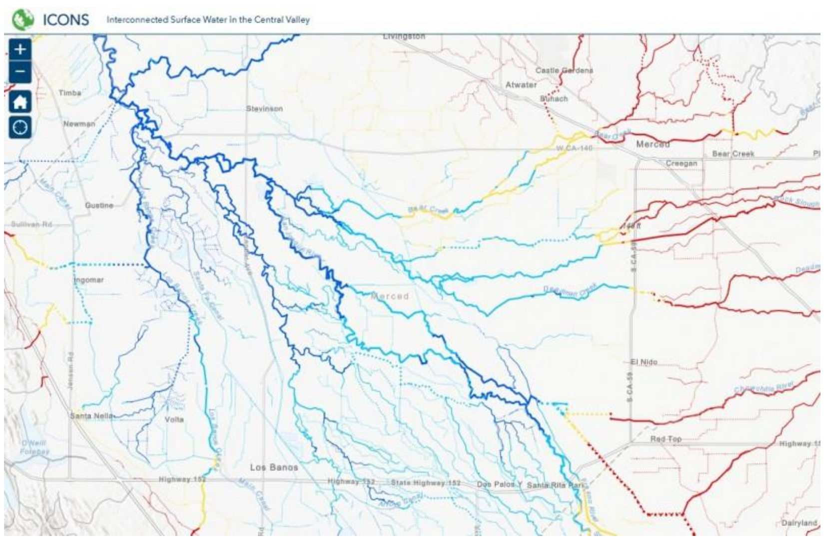
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Sacramento Valley-Butte Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Sacramento Valley-Butte Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

WEST-BUTTE

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Ardea herodias	Great Blue Heron			
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Candidate - Threatened	Endangered	
Grus canadensis tabida	Greater Sandhill Crane		Threatened	
Laterallus jamaicensis coturniculus	California Black Rail	Bird of Conservation Concern	Threatened	
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia brewsteri	A Yellow Warbler	Bird of Conservation Concern	Special Concern	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus buccinator	Trumpeter Swan			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			

Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
Hyalella spp.	Hyalella spp.			
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
HERPS				

Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Capnia quadrituberosa	Four-knobbed Snowfly			
Ablabesmyia annulata				Not on any status lists
Ablabesmyia spp.	Ablabesmyia spp.			
Acentrella spp.	Acentrella spp.			
Acentrella turbida	A Mayfly			
Ambrysus spp.	Ambrysus spp.			
Ampumixis dispar				Not on any status lists
Anax junius	Common Green Darner			
Argia agrioides	California Dancer			
Argia emma	Emma's Dancer			
Argia nahuana	Aztec Dancer			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetidae fam.	Baetidae fam.			
Baetis flavistriga	A Mayfly			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brachycentrus occidentalis				Not on any status lists
Brechmorhoga mendax	Pale-faced Clubskimmer			
Caenis latipennis	A Mayfly			
Callibaetis pictus	A Mayfly			
Centroptilum album	A Mayfly			

Centroptilum spp.	Centroptilum spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chimarra spp.	Chimarra spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Chloroperlidae fam.	Chloroperlidae fam.			
Cladotanytarsus marki				Not on any status lists
Cladotanytarsus spp.	Cladotanytarsus spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus annulator				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus curryi				Not on any status lists
Cryptochironomus spp.	Cryptochironomus spp.			
Cryptotendipes ariel				Not on any status lists
Cryptotendipes spp.	Cryptotendipes spp.			
Dicrotendipes adnilus				Not on any status lists
Dicrotendipes spp.	Dicrotendipes spp.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Dolophilodes spp.	Dolophilodes spp.			
Dubiraphia spp.	Dubiraphia spp.			
Ecdyonurus criddlei	A Mayfly			
Enallagma carunculatum	Tule Bluet			
Endotribelos hesperium				Not on any status lists
Endotribelos spp.	Endotribelos spp.			
Epeorus spp.	Epeorus spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Erythemis collocata	Western Pondhawk			
Eubrianax edwardsii				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Glossosoma spp.	Glossosoma spp.			
Glossosomatidae fam.	Glossosomatidae fam.			
Goeldichironomus amazonicus				Not on any status lists
Goeldichironomus spp.	Goeldichironomus spp.			
Gomphidae fam.	Gomphidae fam.			
Gomphus kurilis	Pacific Clubtail			

Helicopsyche spp.	Helicopsyche spp.			
Heptageniidae fam.	Heptageniidae fam.			
Hetaerina americana	American Rubyspot			
Homoleptohyphes dimorphus	A Mayfly			
Hydropsyche californica	A Caddisfly			
Hydropsyche occidentalis	A Caddisfly			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Lepidostoma spp.	Lepidostoma spp.			
Leptoceridae fam.	Leptoceridae fam.			
Leucotrichia pictipes	A Micro Caddisfly			
Leucotrichia spp.	Leucotrichia spp.			
Libellula comanche	Comanche Skimmer			
Libellula forensis	Eight-spotted Skimmer			
Libellula luctuosa	Widow Skimmer			
Libellula pulchella	Twelve-spotted Skimmer			
Libellula saturata	Flame Skimmer			
Libellulidae fam.	Libellulidae fam.			
Liodessus spp.	Liodessus spp.			
Maruina lanceolata				Not on any status lists
Micrasema spp.	Micrasema spp.			
Microcylloepus similis				Not on any status lists
Microcylloepus spp.	Microcylloepus spp.			
Micropsectra spp.	Micropsectra spp.			
Microtendipes spp.	Microtendipes spp.			
Microvelia spp.	Microvelia spp.			
Mideopsis spp.	Mideopsis spp.			
Mystacides alafimbriatus	A Caddisfly			
Mystacides spp.	Mystacides spp.			
Nanocladius anderseni				Not on any status lists
Nanocladius spp.	Nanocladius spp.			
Naucoridae fam.	Naucoridae fam.			
Nectopsyche spp.	Nectopsyche spp.			
Nemouridae fam.	Nemouridae fam.			
Nilothauma spp.	Nilothauma spp.			
Oecetis disjuncta	A Caddisfly			
Oecetis spp.	Oecetis spp.			
Optioservus spp.	Optioservus spp.			

Ordobrevia nubifera				Not on any status lists
Orthocladius spp.	Orthocladius spp.			
Pachydiplax longipennis	Blue Dasher			
Pantala hymenaea	Spot-winged Glider			
Paracladopelma spp.	Paracladopelma spp.			
Parakiefferiella spp.	Parakiefferiella spp.			
Parakiefferiella subaterrima				Not on any status lists
Paraleptophlebia spp.	Paraleptophlebia spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paratanytarsus grimmii				Not on any status lists
Paratanytarsus spp.	Paratanytarsus spp.			
Paratendipes spp.	Paratendipes spp.			
Pentaneura spp.	Pentaneura spp.			
Perlidae fam.	Perlidae fam.			
Petrophila spp.	Petrophila spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Plathemis lydia	Common Whitetail			
Polycentropus spp.	Polycentropus spp.			
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Procloeon spp.	Procloeon spp.			
Protoptila spp.	Protoptila spp.			
Psectrocladius spp.	Psectrocladius spp.			
Psephenus falli				Not on any status lists
Pseudochironomus spp.	Pseudochironomus spp.			
Pteronarcys californica	Giant Salmonfly			
Pteronarcys spp.	Pteronarcys spp.			
Rheotanytarsus hamatus				Not on any status lists
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Serratella micheneri	A Mayfly			
Sialis spp.	Sialis spp.			
Sigara spp.	Sigara spp.			
Simulium anduzei				Not on any status lists
Simulium spp.	Simulium spp.			
Skwala spp.	Skwala spp.			
Sperchon spp.	Sperchon spp.			

Sperchon stellata				Not on any status lists
Stenocolus scutellaris				Not on any status lists
Sympetrum corruptum	Variegated Meadowhawk			
Tanytarsus angulatus				Not on any status lists
Tanytarsus spp.	Tanytarsus spp.			
Tinodes spp.	Tinodes spp.			
Tramea lacerata	Black Saddlebags			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
Wormaldia spp.	Wormaldia spp.			
Zaitzevia parvula				Not on any status lists
Zaitzevia spp.	Zaitzevia spp.			
Zoniagrion exclamationis	Exclamation Damsel			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Ferrissia fragilis	Fragile Ancylid			CS
Ferrissia spp.	Ferrissia spp.			
Galba modicella	Rock Fossaria			CS
Gyraulus spp.	Gyraulus spp.			
Helisoma spp.	Helisoma spp.			
Lymnaea spp.	Lymnaea spp.			
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Planorbidae fam.	Planorbidae fam.			
Sphaeriidae fam.	Sphaeriidae fam.			
Margaritifera falcata	Western Pearlshell		Special	
PLANTS				
Hibiscus lasiocarpos occidentalis			Special	CRPR - 1B.2
Limnanthes floccosa californica	Shippee Meadowfoam	Endangered	Endangered	CRPR - 1B.1
Orcuttia pilosa	Hairy Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Puccinellia simplex	Little Alkali Grass			

Sagittaria sanfordii	Sanford's Arrowhead		Special	CRPR - 1B.2
Tuctoria greenei	Green's Awnless Orcutt Grass	Endangered	Rare	CRPR - 1B.1
Alisma triviale	Northern Water-plantain			
Alnus rhombifolia	White Alder			
Alopecurus carolinianus	Tufted Foxtail			
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Ammannia robusta	Grand Redstem			
Arundo donax	NA			
Azolla filiculoides	NA			
Azolla microphylla	Mexican mosquito fern		Special	CRPR - 4.3
Bacopa eisenii	Gila River Water-hyssop			
Bacopa rotundifolia	NA			
Bergia texana	Texas Bergia			
Bidens tripartita	NA			
Bolboschoenus fluviatilis				Not on any status lists
Bolboschoenus glaucus	NA			Not on any status lists
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Brasenia schreberi	Watershield		Special	CRPR - 2B.3
Brodiaea nana				Not on any status lists
Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Callitriche trochlearis	Waste-water Water-starwort			
Carex densa	Dense Sedge			
Carex feta	Green-sheath Sedge			
Carex nudata	Torrent Sedge			
Carex scopulorum bracteosa	Holm's Rocky Mountain Sedge			
Carex spectabilis	Northwestern Showy Sedge			
Ceratophyllum demersum	Common Hornwort			
Cicendia quadrangularis	Oregon Microcala			
Cotula coronopifolia	NA			

Crassula aquatica	Water Pygmyweed			
Crypsis vaginiflora	NA			
Cyperus bipartitus	Shining Flatsedge			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus iria	NA			Not on any status lists
Cyperus squarrosus	Awned Cyperus			
Damasonium californicum				Not on any status lists
Downingia cuspidata	Toothed Calicoflower			
Downingia insignis	Parti-color Downingia			
Echinochloa oryzoides	NA			
Echinodorus berteroi	Upright Burhead			
Elatine brachysperma	Shortseed Waterwort			
Elatine californica	California Waterwort			
Elatine heterandra	Mosquito Waterwort			
Elatine rubella	Southwestern Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis atropurpurea	Purple Spikerush			
Eleocharis bella	Delicate Spikerush			
Eleocharis coloradoensis				Not on any status lists
Eleocharis engelmannii engelmannii	Engelmann's Spikerush			Not on any status lists
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Eleocharis quadrangulata	NA			
Eleocharis radicans	Rooted Spikerush			
Elodea canadensis	Broad Waterweed			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eragrostis hypnoides	Teal Lovegrass			
Eryngium castrense	Great Valley Eryngo			
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euphorbia hooveri	NA			Not on any status lists

Euthamia occidentalis	Western Fragrant Goldenrod			
Glyceria elata	Tall Mannagrass			
Gratiola ebracteata	Bractless Hedge-hyssop			
Helenium puberulum	Rosilla			
Heteranthera limosa	NA			
Isoetes howellii	NA			
Isoetes nuttallii	NA			
Isoetes orcuttii	NA			
Juncus acuminatus	Sharp-fruit Rush			
Juncus articulatus articulatus				Not on any status lists
Juncus diffusissimus	NA			
Juncus effusus effusus	NA			
Juncus effusus pacificus				
Juncus uncialis	Inch-high Rush			
Juncus usitatus	NA			Not on any status lists
Juncus xiphioides	Iris-leaf Rush			
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lemna minuta	Least Duckweed			
Limnanthes alba alba	White Meadowfoam			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limnanthes douglasii nivea	Douglas' Meadowfoam			
Limosella acaulis	Southern Mudwort			
Limosella aquatica	Northern Mudwort			
Lindernia dubia	Yellowseed False Pimpernel			
Ludwigia hexapetala	NA			Not on any status lists
Ludwigia palustris	Marsh Seedbox			
Ludwigia peploides montevidensis	NA			Not on any status lists
Ludwigia peploides peploides	NA			Not on any status lists
Lycopus americanus	American Bugleweed			
Lythrum californicum	California Loosestrife			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			

Mimulus tricolor	Tricolor Monkeyflower			
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Myriophyllum aquaticum	NA			
Myriophyllum hippuroides	Western Water-milfoil			
Najas gracillima	NA			
Najas guadalupensis guadalupensis	Southern Naiad			
Navarretia cotulifolia	Cotula Navarretia			
Navarretia heterandra	Tehama Navarretia			
Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala bakeri	Baker's Navarretia		Special	CRPR - 1B.1
Navarretia leucocephala leucocephala	White-flower Navarretia			
Panicum dichotomiflorum	NA			
Paspalum distichum	Joint Paspalum			
Perideridia bolanderi involucrata	Bolander's Yampah			
Perideridia kelloggii	Kellogg's Yampah			
Persicaria hydropiper	NA			Not on any status lists
Persicaria hydropiperoides				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria pensylvanica	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Pilularia americana	NA			
Plagiobothrys austiniae	Austin's Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pogogyne zizyphoroides				Not on any status lists

Potamogeton diversifolius	Water-thread Pondweed			
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton natans	Floating Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Ranunculus bonariensis	NA			
Ranunculus pusillus pusillus	Pursh's Buttercup			
Ranunculus sceleratus	NA			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rorippa palustris palustris	Bog Yellowcress			
Rotala ramosior	Toothcup			
Rumex conglomeratus	NA			
Rumex fueginus				Not on any status lists
Rumex salicifolius salicifolius	Willow Dock			
Rumex stenophyllus	NA			
Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Sagittaria longiloba	Longbarb Arrowhead			
Sagittaria montevidensis calycina				Not on any status lists
Salix babylonica	NA			
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus mucronatus	NA			
Schoenoplectus tabernaemontani	Softstem Bulrush			
Scirpus microcarpus	Small-fruit Bulrush			
Sidalcea hirsuta	Hairy Checker-mallow			
Sinapis alba	NA			

Sparganium eurycarpum eurycarpum				
Stachys ajugoides	Bugle Hedge-nettle			
Stachys pycnantha	Short-spike Hedge-nettle			
Stachys stricta	Sonoma Hedge-nettle			
Stuckenia pectinata				Not on any status lists
Suaeda calceoliformis	American Sea-blite			
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Utricularia gibba	Humped Bladderwort			
Wolffia brasiliensis	Pointed Watermeal		Special	CRPR - 2B.3
Wolffia globosa	Asian Watermeal			
Wolffiella oblonga	Saber-shape Bogmat			
Zannichellia palustris	Horned Pondweed			

EAST BUTTE

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Ardea herodias	Great Blue Heron			
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Candidate - Threatened	Endangered	
Grus canadensis tabida	Greater Sandhill Crane		Threatened	
Laterallus jamaicensis coturniculus	California Black Rail	Bird of Conservation Concern	Threatened	
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia brewsteri	A Yellow Warbler	Bird of Conservation Concern	Special Concern	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			

Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus buccinator	Trumpeter Swan			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			

Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
Hyalella spp.	Hyalella spp.			
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC

Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Capnia quadrituberosa	Four-knobbed Snowfly			
Ablabesmyia annulata				Not on any status lists
Ablabesmyia spp.	Ablabesmyia spp.			
Acentrella spp.	Acentrella spp.			
Acentrella turbida	A Mayfly			
Ambrysus spp.	Ambrysus spp.			
Ampumixis dispar				Not on any status lists
Anax junius	Common Green Darner			
Argia agrioides	California Dancer			
Argia emma	Emma's Dancer			
Argia nahuana	Aztec Dancer			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetidae fam.	Baetidae fam.			
Baetis flavistriga	A Mayfly			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brachycentrus occidentalis				Not on any status lists
Brechmorhoga mendax	Pale-faced Clubskimmer			
Caenis latipennis	A Mayfly			
Callibaetis pictus	A Mayfly			
Centroptilum album	A Mayfly			
Centroptilum spp.	Centroptilum spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chimarra spp.	Chimarra spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Chloroperlidae fam.	Chloroperlidae fam.			
Cladotanytarsus marki				Not on any status lists
Cladotanytarsus spp.	Cladotanytarsus spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus annulator				Not on any status lists
Cricotopus spp.	Cricotopus spp.			

Cryptochironomus curryi				Not on any status lists
Cryptochironomus spp.	Cryptochironomus spp.			
Cryptotendipes ariel				Not on any status lists
Cryptotendipes spp.	Cryptotendipes spp.			
Dicrotendipes adnilus				Not on any status lists
Dicrotendipes spp.	Dicrotendipes spp.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Dolophilodes spp.	Dolophilodes spp.			
Dubiraphia spp.	Dubiraphia spp.			
Ecdyonurus criddlei	A Mayfly			
Enallagma carunculatum	Tule Bluet			
Endotribelos hesperium				Not on any status lists
Endotribelos spp.	Endotribelos spp.			
Epeorus spp.	Epeorus spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Erythemis collocata	Western Pondhawk			
Eubrianax edwardsii				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Glossosoma spp.	Glossosoma spp.			
Glossosomatidae fam.	Glossosomatidae fam.			
Goeldichironomus amazonicus				Not on any status lists
Goeldichironomus spp.	Goeldichironomus spp.			
Gomphidae fam.	Gomphidae fam.			
Gomphus kurilis	Pacific Clubtail			
Helicopsyche spp.	Helicopsyche spp.			
Heptageniidae fam.	Heptageniidae fam.			
Hetaerina americana	American Rubyspot			
Homoleptohyphes dimorphus	A Mayfly			
Hydropsyche californica	A Caddisfly			
Hydropsyche occidentalis	A Caddisfly			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Lepidostoma spp.	Lepidostoma spp.			
Leptoceridae fam.	Leptoceridae fam.			
Leucotrichia pictipes	A Micro Caddisfly			
Leucotrichia spp.	Leucotrichia spp.			
Libellula comanche	Comanche Skimmer			

Libellula forensis	Eight-spotted Skimmer			
Libellula luctuosa	Widow Skimmer			
Libellula pulchella	Twelve-spotted Skimmer			
Libellula saturata	Flame Skimmer			
Libellulidae fam.	Libellulidae fam.			
Liodessus spp.	Liodessus spp.			
Maruina lanceolata				Not on any status lists
Micrasema spp.	Micrasema spp.			
Microcylloepus similis				Not on any status lists
Microcylloepus spp.	Microcylloepus spp.			
Micropsectra spp.	Micropsectra spp.			
Microtendipes spp.	Microtendipes spp.			
Microvelia spp.	Microvelia spp.			
Mideopsis spp.	Mideopsis spp.			
Mystacides alafimbriatus	A Caddisfly			
Mystacides spp.	Mystacides spp.			
Nanocladius anderseni				Not on any status lists
Nanocladius spp.	Nanocladius spp.			
Naucoridae fam.	Naucoridae fam.			
Nectopsyche spp.	Nectopsyche spp.			
Nemouridae fam.	Nemouridae fam.			
Nilothauma spp.	Nilothauma spp.			
Oecetis disjuncta	A Caddisfly			
Oecetis spp.	Oecetis spp.			
Optioservus spp.	Optioservus spp.			
Ordobrevia nubifera				Not on any status lists
Orthocladius spp.	Orthocladius spp.			
Pachydiplax longipennis	Blue Dasher			
Pantala hymenaea	Spot-winged Glider			
Paracladopelma spp.	Paracladopelma spp.			
Parakiefferiella spp.	Parakiefferiella spp.			
Parakiefferiella subaterrima				Not on any status lists
Paraleptophlebia spp.	Paraleptophlebia spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paratanytarsus grimmii				Not on any status lists
Paratanytarsus spp.	Paratanytarsus spp.			
Paratendipes spp.	Paratendipes spp.			
Pentaneura spp.	Pentaneura spp.			
Perlidae fam.	Perlidae fam.			
Petrophila spp.	Petrophila spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Plathemis lydia	Common Whitetail			

Polycentropus spp.	Polycentropus spp.			
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Procloeon spp.	Procloeon spp.			
Protoptila spp.	Protoptila spp.			
Psectrocladius spp.	Psectrocladius spp.			
Psephenus falli				Not on any status lists
Pseudochironomus spp.	Pseudochironomus spp.			
Pteronarcys californica	Giant Salmonfly			
Pteronarcys spp.	Pteronarcys spp.			
Rheotanytarsus hamatus				Not on any status lists
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Serratella micheneri	A Mayfly			
Sialis spp.	Sialis spp.			
Sigara spp.	Sigara spp.			
Simulium anduzei				Not on any status lists
Simulium spp.	Simulium spp.			
Skwala spp.	Skwala spp.			
Sperchon spp.	Sperchon spp.			
Sperchon stellata				Not on any status lists
Stenocolus scutellaris				Not on any status lists
Sympetrum corruptum	Variegated Meadowhawk			
Tanytarsus angulatus				Not on any status lists
Tanytarsus spp.	Tanytarsus spp.			
Tinodes spp.	Tinodes spp.			
Tramea lacerata	Black Saddlebags			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
Wormaldia spp.	Wormaldia spp.			
Zaitzevia parvula				Not on any status lists
Zaitzevia spp.	Zaitzevia spp.			
Zoniagrion exclamationis	Exclamation Damsel			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists

Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Ferrissia fragilis	Fragile Ancylid			CS
Ferrissia spp.	Ferrissia spp.			
Galba modicella	Rock Fossaria			CS
Gyraulus spp.	Gyraulus spp.			
Helisoma spp.	Helisoma spp.			
Lymnaea spp.	Lymnaea spp.			
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Planorbidae fam.	Planorbidae fam.			
Sphaeriidae fam.	Sphaeriidae fam.			
Margaritifera falcata	Western Pearlshell		Special	
PLANTS				
Hibiscus lasiocarpos occidentalis			Special	CRPR - 1B.2
Limnanthes floccosa californica	Shippee Meadowfoam	Endangered	Endangered	CRPR - 1B.1
Orcuttia pilosa	Hairy Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Puccinellia simplex	Little Alkali Grass			
Sagittaria sanfordii	Sanford's Arrowhead		Special	CRPR - 1B.2
Tuctoria greenei	Green's Awnless Orcutt Grass	Endangered	Rare	CRPR - 1B.1
Alisma triviale	Northern Water-plantain			
Alnus rhombifolia	White Alder			
Alopecurus carolinianus	Tufted Foxtail			
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Ammannia robusta	Grand Redstem			
Arundo donax	NA			
Azolla filiculoides	NA			
Azolla microphylla	Mexican mosquito fern		Special	CRPR - 4.3
Bacopa eisenii	Gila River Water-hyssop			
Bacopa rotundifolia	NA			
Bergia texana	Texas Bergia			
Bidens tripartita	NA			
Bolboschoenus fluviatilis				Not on any status lists
Bolboschoenus glaucus	NA			Not on any status lists
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Brasenia schreberi	Watershield		Special	CRPR - 2B.3
Brodiaea nana				Not on any status lists

Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Callitriche trochlearis	Waste-water Water-starwort			
Carex densa	Dense Sedge			
Carex feta	Green-sheath Sedge			
Carex nudata	Torrent Sedge			
Carex scopulorum bracteosa	Holm's Rocky Mountain Sedge			
Carex spectabilis	Northwestern Showy Sedge			
Ceratophyllum demersum	Common Hornwort			
Cicendia quadrangularis	Oregon Microcala			
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Crypsis vaginiflora	NA			
Cyperus bipartitus	Shining Flatsedge			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus iria	NA			Not on any status lists
Cyperus squarrosus	Awned Cyperus			
Damasonium californicum				Not on any status lists
Downingia cuspidata	Toothed Calicoflower			
Downingia insignis	Parti-color Downingia			
Echinochloa oryzoides	NA			
Echinodorus berteroi	Upright Burhead			
Elatine brachysperma	Shortseed Waterwort			
Elatine californica	California Waterwort			
Elatine heterandra	Mosquito Waterwort			
Elatine rubella	Southwestern Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis atropurpurea	Purple Spikerush			
Eleocharis bella	Delicate Spikerush			
Eleocharis coloradoensis				Not on any status lists
Eleocharis engelmannii engelmannii	Engelmann's Spikerush			Not on any status lists
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Eleocharis quadrangulata	NA			
Eleocharis radicans	Rooted Spikerush			

Elodea canadensis	Broad Waterweed			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eragrostis hypnoides	Teal Lovegrass			
Eryngium castrense	Great Valley Eryngo			
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euphorbia hooveri	NA			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Glyceria elata	Tall Mannagrass			
Gratiola ebracteata	Bractless Hedge-hyssop			
Helenium puberulum	Rosilla			
Heteranthera limosa	NA			
Isoetes howellii	NA			
Isoetes nuttallii	NA			
Isoetes orcuttii	NA			
Juncus acuminatus	Sharp-fruit Rush			
Juncus articulatus articulatus				Not on any status lists
Juncus diffusissimus	NA			
Juncus effusus effusus	NA			
Juncus effusus pacificus				
Juncus uncialis	Inch-high Rush			
Juncus usitatus	NA			Not on any status lists
Juncus xiphioides	Iris-leaf Rush			
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lemna minuta	Least Duckweed			
Limnanthes alba alba	White Meadowfoam			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limnanthes douglasii nivea	Douglas' Meadowfoam			
Limosella acaulis	Southern Mudwort			
Limosella aquatica	Northern Mudwort			
Lindernia dubia	Yellowseed False Pimpernel			
Ludwigia hexapetala	NA			Not on any status lists
Ludwigia palustris	Marsh Seedbox			
Ludwigia peploides montevidensis	NA			Not on any status lists
Ludwigia peploides peploides	NA			Not on any status lists
Lycopus americanus	American Bugleweed			

Lythrum californicum	California Loosestrife			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Mimulus tricolor	Tricolor Monkeyflower			
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Myriophyllum aquaticum	NA			
Myriophyllum hippuroides	Western Water-milfoil			
Najas gracillima	NA			
Najas guadalupensis guadalupensis	Southern Naiad			
Navarretia cotulifolia	Cotula Navarretia			
Navarretia heterandra	Tehama Navarretia			
Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala bakeri	Baker's Navarretia		Special	CRPR - 1B.1
Navarretia leucocephala leucocephala	White-flower Navarretia			
Panicum dichotomiflorum	NA			
Paspalum distichum	Joint Paspalum			
Perideridia bolanderi involucrata	Bolander's Yampah			
Perideridia kelloggii	Kellogg's Yampah			
Persicaria hydropiper	NA			Not on any status lists
Persicaria hydropiperoides				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria pensylvanica	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Pilularia americana	NA			
Plagiobothrys austiniae	Austin's Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pogogyne zizyphoroides				Not on any status lists
Potamogeton diversifolius	Water-thread Pondweed			

Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton natans	Floating Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Ranunculus bonariensis	NA			
Ranunculus pusillus pusillus	Pursh's Buttercup			
Ranunculus sceleratus	NA			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rorippa palustris palustris	Bog Yellowcress			
Rotala ramosior	Toothcup			
Rumex conglomeratus	NA			
Rumex fueginus				Not on any status lists
Rumex salicifolius salicifolius	Willow Dock			
Rumex stenophyllus	NA			
Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Sagittaria longiloba	Longbarb Arrowhead			
Sagittaria montevidensis calycina				Not on any status lists
Salix babylonica	NA			
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus mucronatus	NA			
Schoenoplectus tabernaemontani	Softstem Bulrush			
Scirpus microcarpus	Small-fruit Bulrush			
Sidalcea hirsuta	Hairy Checker-mallow			
Sinapis alba	NA			
Sparganium eurycarpum eurycarpum				
Stachys ajugoides	Bugle Hedge-nettle			
Stachys pycnantha	Short-spike Hedge-nettle			
Stachys stricta	Sonoma Hedge-nettle			
Stuckenia pectinata				Not on any status lists
Suaeda calceoliformis	American Sea-blite			

Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Utricularia gibba	Humped Bladderwort			
Wolffia brasiliensis	Pointed Watermeal		Special	CRPR - 2B.3
Wolffia globosa	Asian Watermeal			
Wolffiella oblonga	Saber-shape Bogmat			
Zannichellia palustris	Horned Pondweed			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

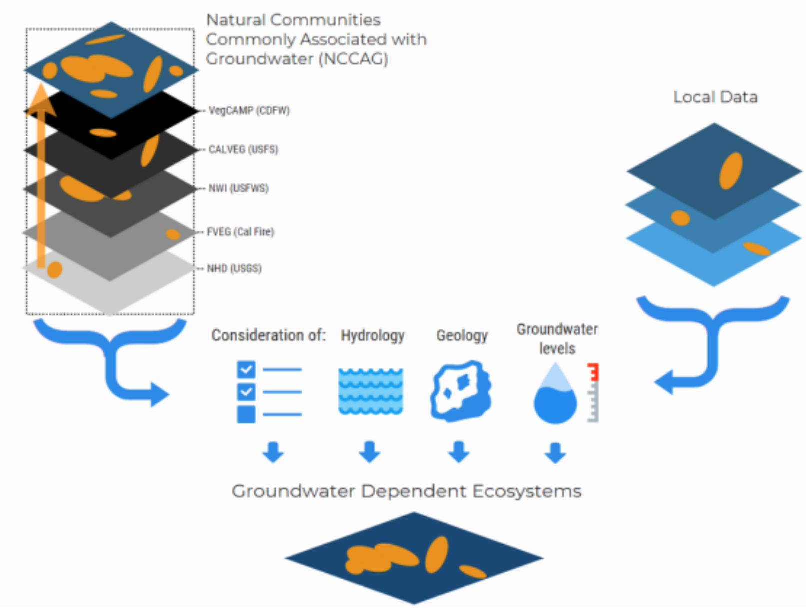


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

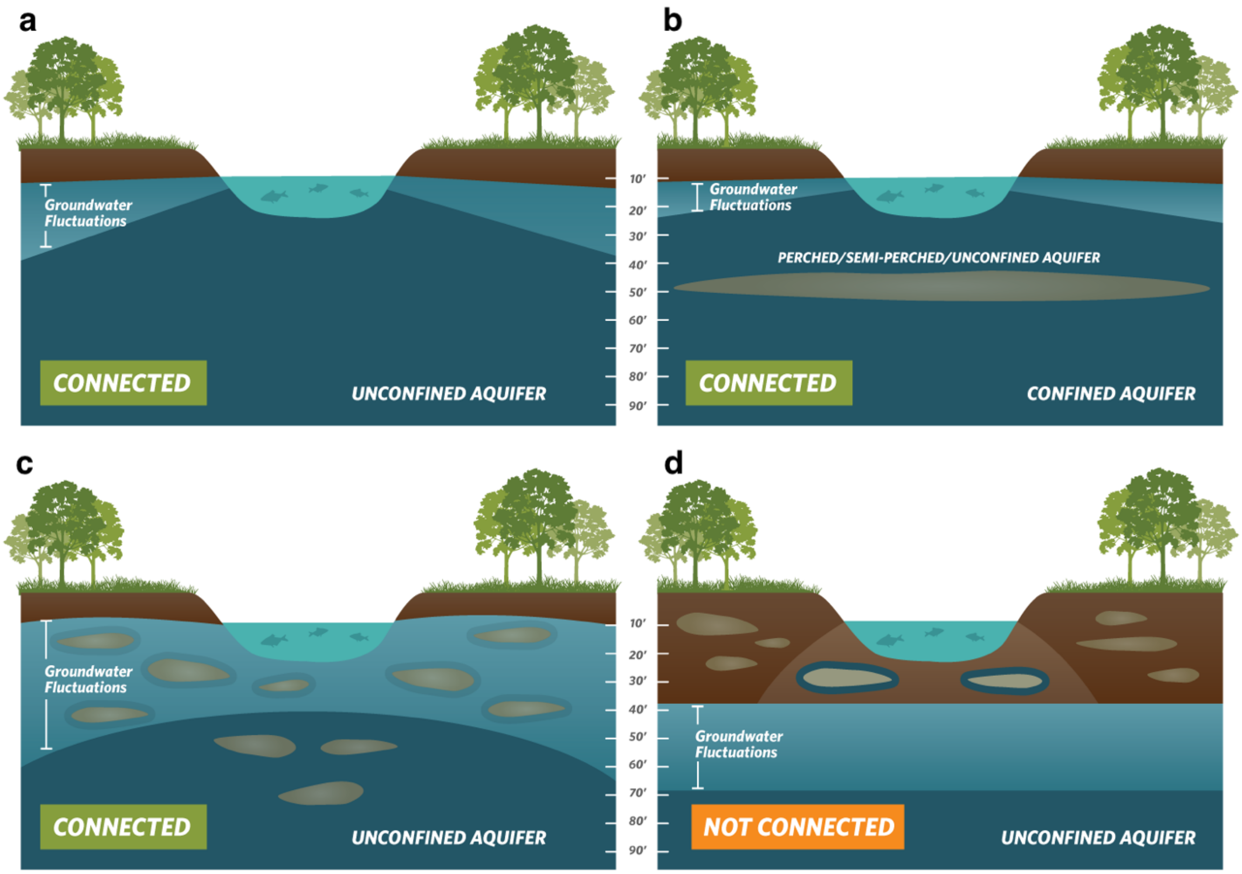


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

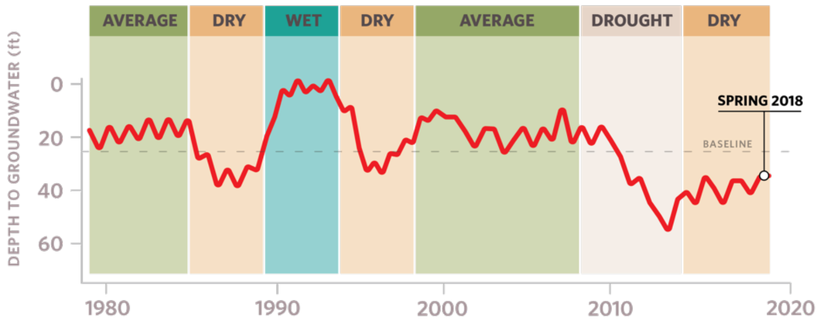


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

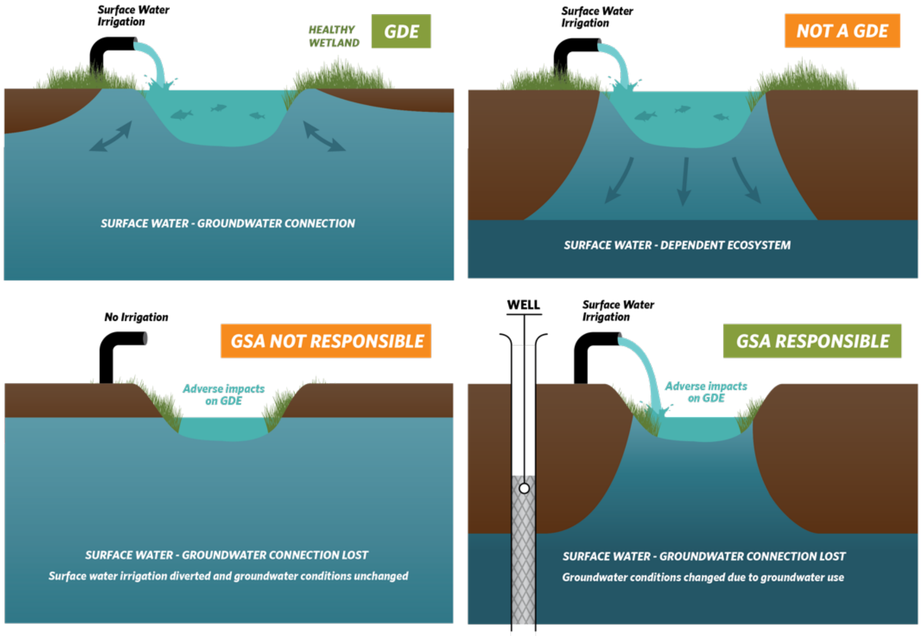


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

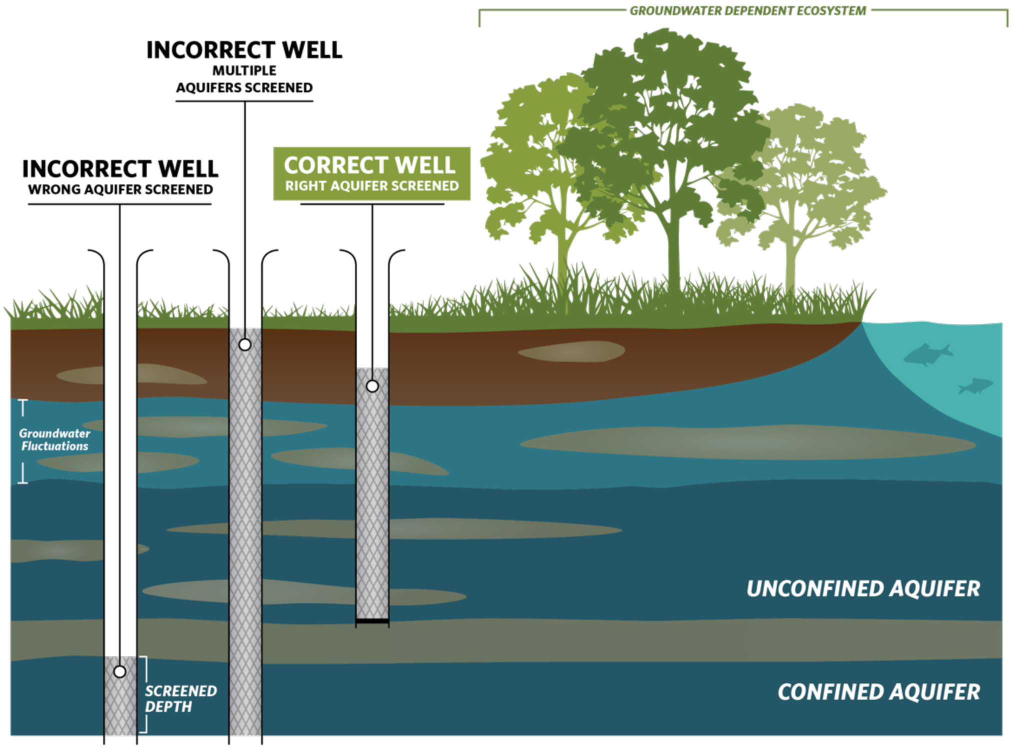


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

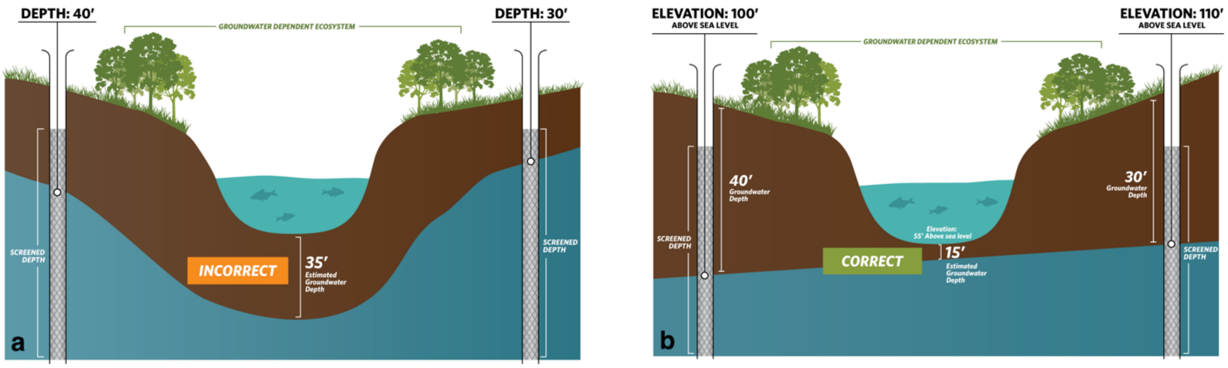


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

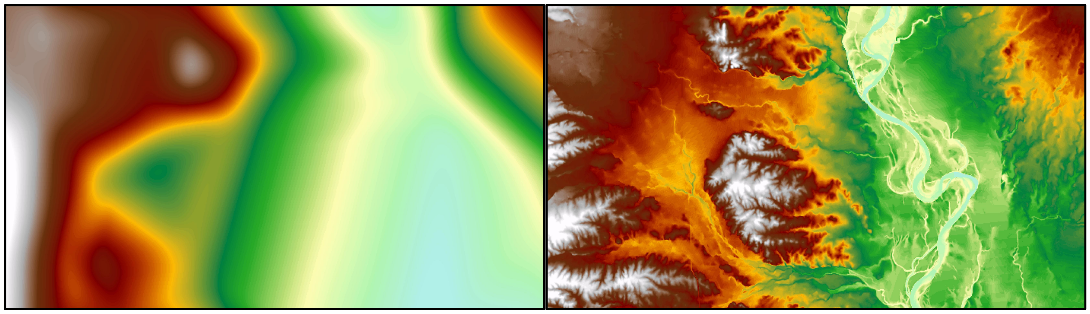


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

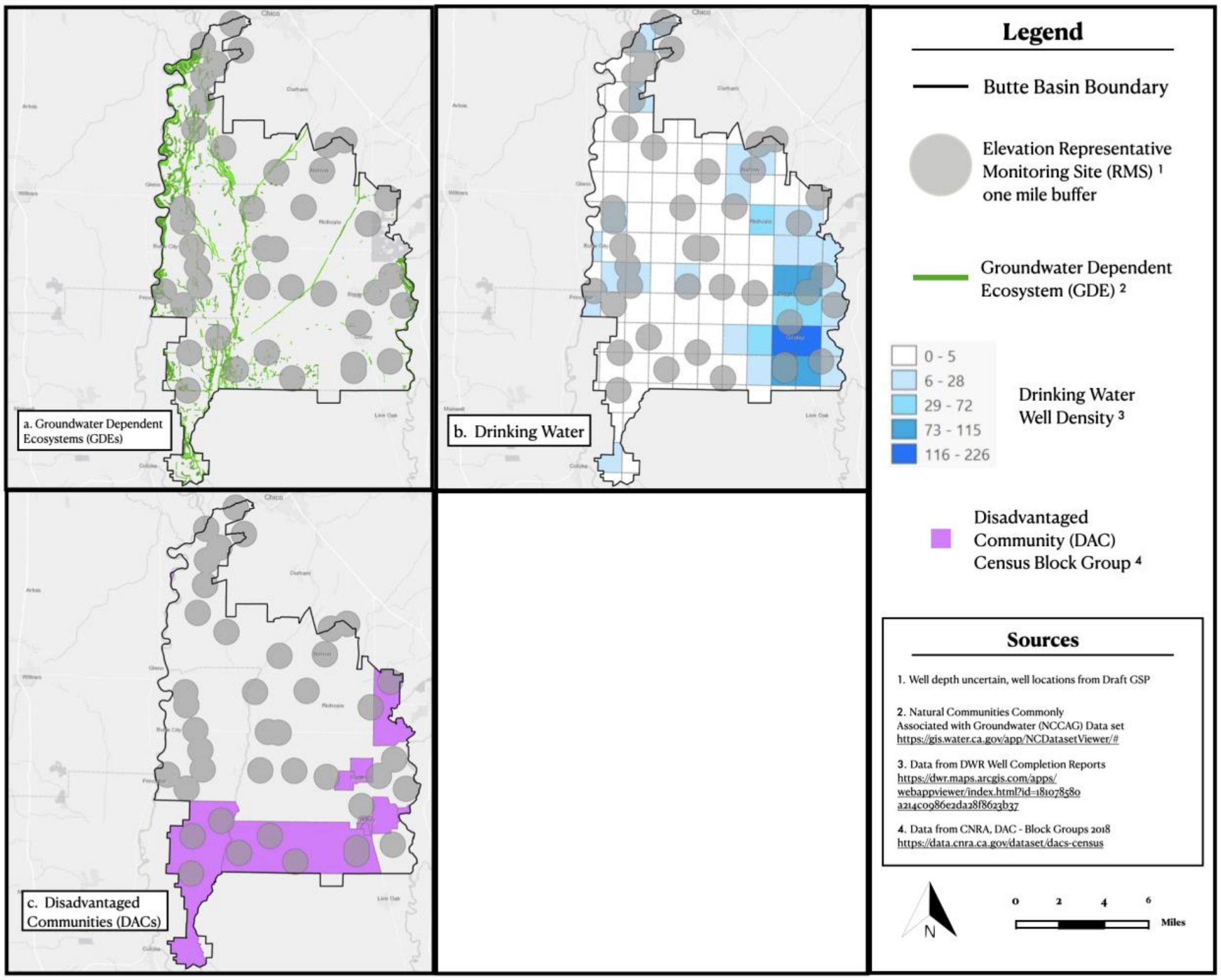


Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

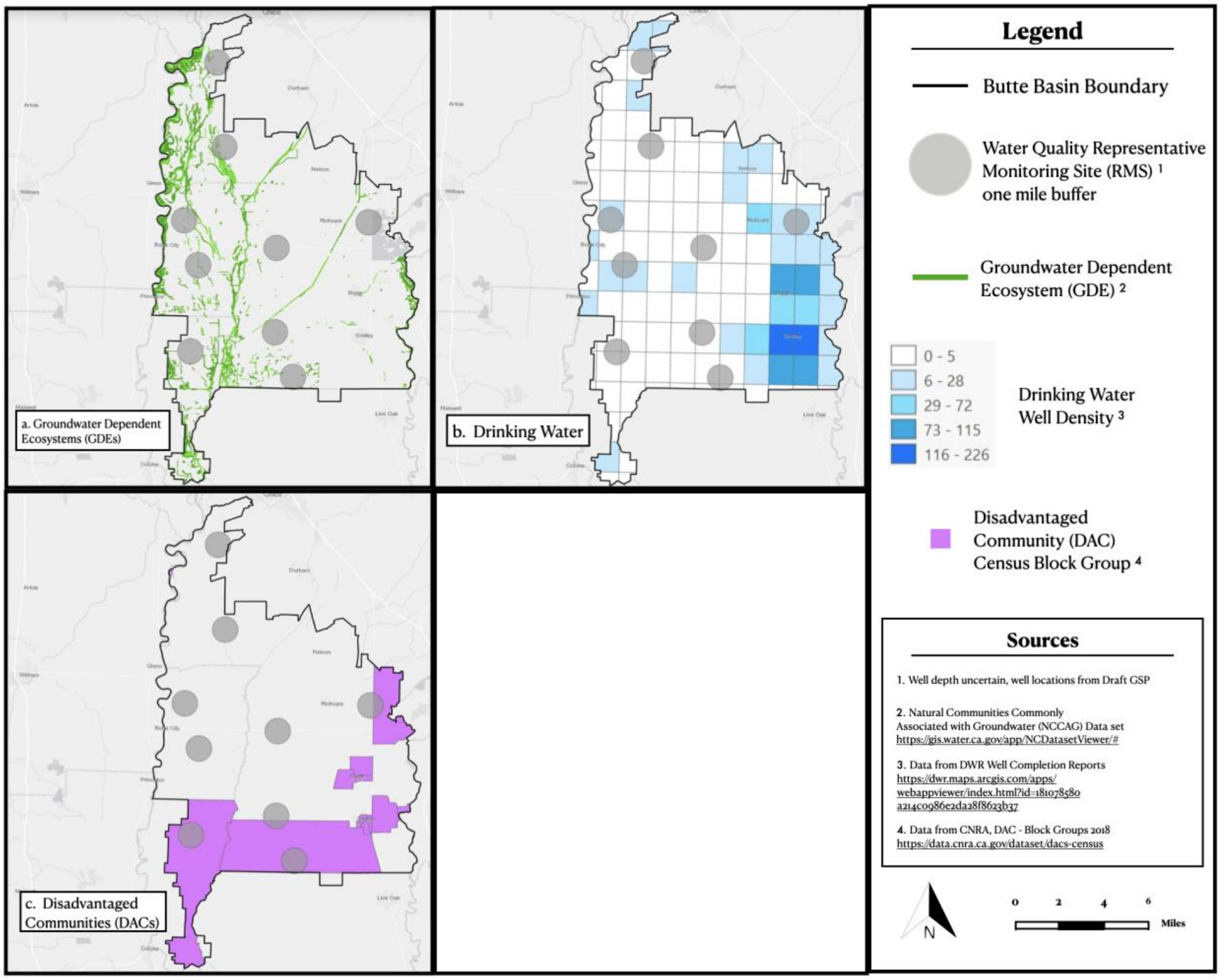


Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

October 31, 2021

Colusa Groundwater Authority
1213 Market Street
Colusa, CA 95932

Submitted via email:lhunter@countyofglenn.net; mfahey@countyofcolusa.com

Re: Public Comment Letter for Colusa Subbasin Draft GSP

Dear Mary Fahey,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Colusa Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Colusa Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
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Samantha Arthur
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Acting Director, California Program
American Rivers

Kristan Culbert
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American Rivers

Attachment A

Specific Comments on the Colusa Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **incomplete**. The GSP provides a map of tribal lands in the subbasin (Figure 2-5), and provides information on DACs, including identification by name and location on a map (Figure 2-6). However, the plan fails to clearly document the population of each DAC and the population dependent on groundwater as their source of drinking water in the subbasin.

While the plan provides a density map of domestic wells in the subbasin (Figure 2-7), the GSP fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.

These missing elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide the population of each identified DAC. Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). • Include a map showing domestic well locations and average well depth across the subbasin (i.e., a map similar to Figure 2-7 showing average well depth per square mile).

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of a comprehensive map of ISWs in the subbasin. Despite the lack of an ISW map, the GSP presents a thorough, comprehensive evaluation of ISWs in the subbasin as presented in Appendix 3G of the GSP (Evaluation of Depletions of Interconnected Surface Water in the Colusa Subbasin). Streamflow depletion in the Colusa Subbasin was evaluated using the C2VSimFG-Colusa model, an integrated hydrologic flow model for the subbasin. The model is described in Appendix 3D (Model Development and Calibration) and used groundwater and surface water data from 1990-2015. Appendix 3D describes the groundwater data used in the model, including spatial location of wells and screening depths. The ISW section of the GSP could be improved with the following recommendations.

RECOMMENDATIONS
• Provide a map showing all the stream reaches in the subbasin, with reaches clearly labeled as interconnected (gaining and losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP. • Discuss stream reaches in the interior of the subbasin. For example, discuss whether they were included in the groundwater model and discuss relevant depth to groundwater data. Clearly state that they are considered to be disconnected, if that is the case, and what data was utilized to support that conclusion. • To confirm the results of the groundwater modeling analysis and support conclusions about the smaller interior stream reaches, overlay the stream reaches shown with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, we found that some mapped features in the NC dataset were improperly disregarded. NC dataset polygons were incorrectly removed in areas adjacent to irrigated fields or due to the presence of surface water supplies. However, this removal criteria is flawed since GDEs, in addition to groundwater, can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields – simultaneously and at different temporal/spatial scales. NC dataset polygons adjacent to irrigated land or surface water supplies can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to irrigated fields or surface water supplies.

The GSP states (3-82): "*Average spring groundwater level data from 2014 to 2018 indicates that shallow groundwater levels (i.e., within 30 feet of ground surface) exists throughout most of the* *subbasin. A depth to water (DTW) of 30 feet based on the average DTW for 2014 to 2018 was used as one of the primary criteria in the initial screening of potential GDEs.*" While we recognize that the period 2014-2018 represents multiple water year types, we recommend that a longer baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions.

The GSP does not provide an inventory of the flora or fauna species present in the subbasin's GDEs, except to discuss the four most prevalent vegetation species. Furthermore, the GSP does not acknowledge endangered, threatened, or special status species in the subbasin.

RECOMMENDATIONS

- Provide a comprehensive set of maps for the subbasin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained, removed, or added to/from the NC dataset (include the removal reason if polygons are not considered potential GDEs, or include the data source if polygons are added). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network. It is not clear from the description in the GSP whether NC dataset polygons labeled with a 'GDE Likelihood Score' of 1 to 3 on Figure 3-36 are retained as potential GDEs.

- Include an inventory of the fauna and flora present within the subbasin's GDEs (see Attachment C of this letter for a list of freshwater species located in the Colusa Subbasin). Note any threatened or endangered species.

Native Vegetation and Managed Wetlands
Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of these ecosystems into the water budget is **sufficient** because the GSP included the groundwater demands of native vegetation and managed wetlands in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP Development
Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Stakeholder Communication and Engagement Plan (Appendix 2E).[4]

We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement with DACs, drinking water users, tribes, and environmental stakeholders are described in very general terms. They include technical and informational workshops and meetings open to the public. No specific outreach targeted to DACs, drinking water users, tribes, or environmental stakeholders is described in the GSP.

- The plan does not include a plan for continual opportunities for engagement through the *implementation* phase of the GSP for DACs, domestic well owners, tribes, and environmental stakeholders.

RECOMMENDATIONS

- In the Stakeholder Communication and Engagement Plan, describe active and targeted outreach to engage DACs, drinking water users, tribes, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Describe efforts to consult and engage with DACs and domestic well owners within the subbasin.

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[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]
[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]
[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the subbasin within the GSP.[5]

- Describe efforts to consult and engage with environmental stakeholders within the subbasin.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the minimum threshold at representative monitoring wells is calculated by finding the deeper value of: (1) 20th percentile of shallowest domestic well depths in the monitoring well's Thiessen polygon, and (2) 50% of range below the historical low groundwater elevation. The GSP states (p. 5-20): *"The GSAs chose this methodology for calculating the minimum threshold to balance the needs of multiple beneficial uses and users of the groundwater by allowing for adequate flexibility to compensate for drought periods while potentially protecting up to 80 percent of nearby domestic wells, therefore avoiding undesirable results. Additionally, anecdotal evidence provided by the GSA member stakeholders suggest that groundwater levels seen in 2015 did not result in significant and unreasonable impacts to beneficial uses and users. Although some wells in that period were dewatered, those wells were generally replaced with deeper wells. The GSAs therefore consider the historical low groundwater elevation to be protective of current and future beneficial uses and users."* Despite this analysis, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users in those 20% not protected by the minimum threshold, and whether the undesirable results are consistent with the Human Right to Water policy.[9]

In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs or tribes when defining undesirable results, nor does it describe how the groundwater levels minimum threshold will avoid significant and unreasonable impacts on beneficial users beyond 2015 and be consistent with Human Right to Water policy.

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[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

The GSP states (3-67): *"Groundwater quality concerns within the Colusa Subbasin include locally elevated levels of salinity, TDS, adjusted sodium absorption ratio, arsenic, boron, hexavalent chromium, iron, manganese, and nitrate."* However, for degraded water quality, salinity is the only constituent of concern (COC) for which SMC are established in the subbasin. The minimum threshold for salinity has been established for electrical conductivity (EC) as the higher of either the recommended California Secondary Maximum Contaminant Level (SMCL), or the pre-2015 historical maximum recorded EC value. The use of the latter term, with no values associated with it, is inappropriate; the Plan must provide actual historical data identifying what this minimum threshold would be. Furthermore, this value should not in any case exceed the salinity objective in the Basin Plan.

The GSP states (5-11): *"Existing regulatory programs address most water quality concerns, and the CGA and GGA will coordinate with these programs, the lead regulatory agencies, and the regulated community within the Colusa Subbasin during implementation of this GSP, including during development and implementation of projects and management actions."* However, SMC should be established for all COCs in the subbasin impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[10]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.

- For EC, provide a summary table that presents the pre-2015 historical maximums, the salinity objective from the Basin Plan, the SMCL, and the resulting minimum thresholds. Ensure that the minimum thresholds do not exceed the salinity objective in the Basin Plan.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management. Ensure they align with drinking water standards.[11]

[10] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[11] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts to GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC for chronic lowering of groundwater levels.

Sustainable management criteria for depletion of interconnected surface water are established by proxy using groundwater levels at existing monitoring wells with locations and depths considered appropriate for monitoring groundwater with potential to influence interconnected streams. Minimum thresholds were established at groundwater levels that are 10 feet deeper than the observed Fall 2015 water level. However, if minimum thresholds are set to levels lower than historic low groundwater levels and the subbasin is allowed to operate at or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse.

No analysis or discussion is presented to describe how the SMC will affect GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin.[12] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[13]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

[12] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[13] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[14] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,15]

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[16] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[17] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP incorporates climate change into key inputs of (e.g., precipitation and evapotranspiration) of the projected water budget. However, imported water should also be adjusted for climate change and incorporated into the surface water flow inputs of the projected water budget. The sustainable yield is calculated based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios and the omission of projected climate change effects on imported water inputs, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future

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[14] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[15] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[16] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[17] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, domestic well owners, and tribes.

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change into surface water flow inputs, including imported water, for the projected water budget.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, tribes, GDEs, and ISWs in the subbasin.

Figure 4-6 (Representative Groundwater Level Monitoring Network) shows insufficient representation of drinking water users and tribal users for groundwater elevation monitoring. Figure 4-7 (Representative Groundwater Quality Monitoring Network) shows insufficient representation of DACs and tribal users for water quality monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[18]

The GSP provides some discussion of data gaps for GDEs and ISWs in Sections 4.2.4.5 (Proposed Actions to Address Data Gaps) and Section 7.1.2.1 (Expand Shallow Groundwater Level Monitoring Network), but does not provide specific plans, such as locations or a timeline, to fill the data gaps.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, tribes, GDEs, and ISWs to clearly identify potentially impacted areas.
- Increase the number of RMSs in the shallow aquifer across the subbasin as needed to adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, tribes, and GDEs when identifying new RMSs.

[18] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

- Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, tribes, and GDEs.

- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient** due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, drinking water users, and tribes. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

We commend the GSAs for including the Colusa Subbasin Multi-Benefit Groundwater Recharge project, developed in partnership with The Nature Conservancy. The GSP describes the multiple benefits of this project, including benefits to migratory shorebirds, DACs, private landowners, and groundwater conditions.

The GSP includes a domestic well mitigation program. However, the mitigation program is described as a potential project to be implemented on an as-needed basis instead of a proposed project that will be implemented within the GSP planning horizon.

RECOMMENDATIONS

- Clarify the planning horizon of the described domestic well mitigation program to ensure that it will proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

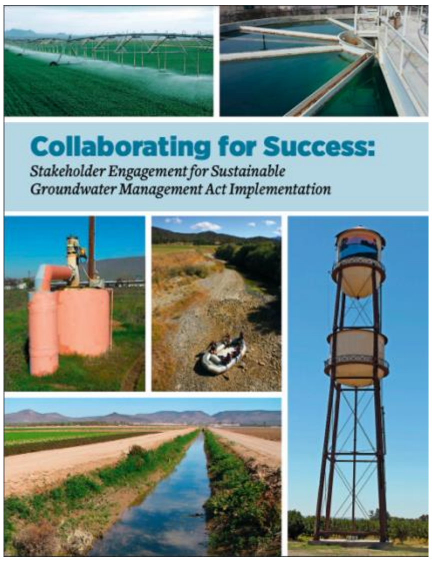
- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSAs plans to mitigate such impacts.

- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

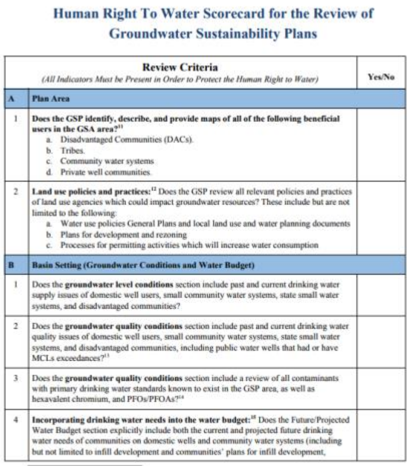
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

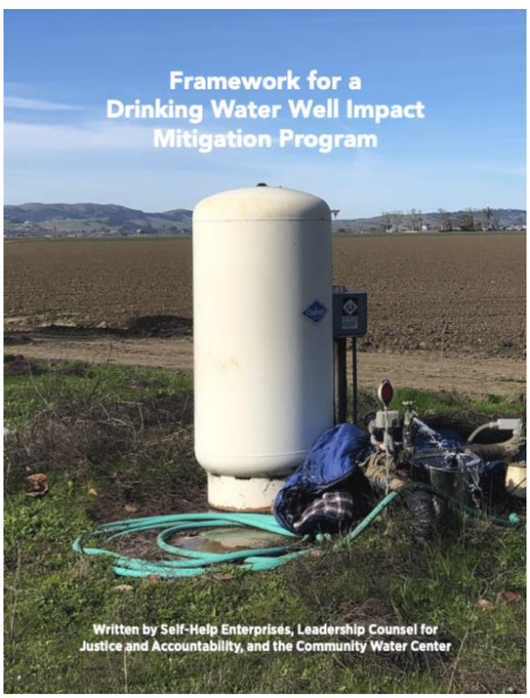


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

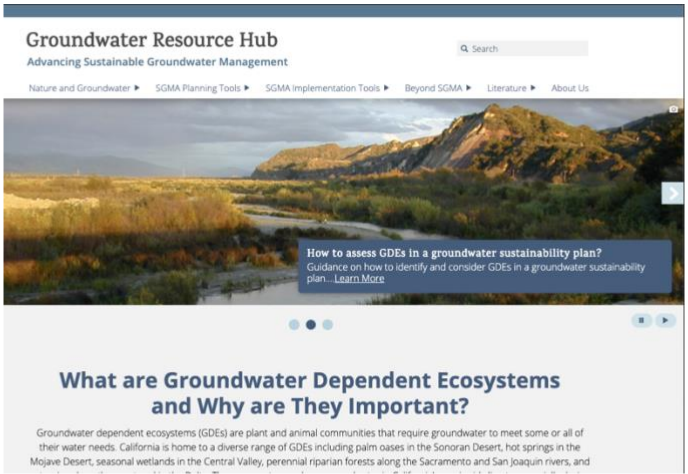
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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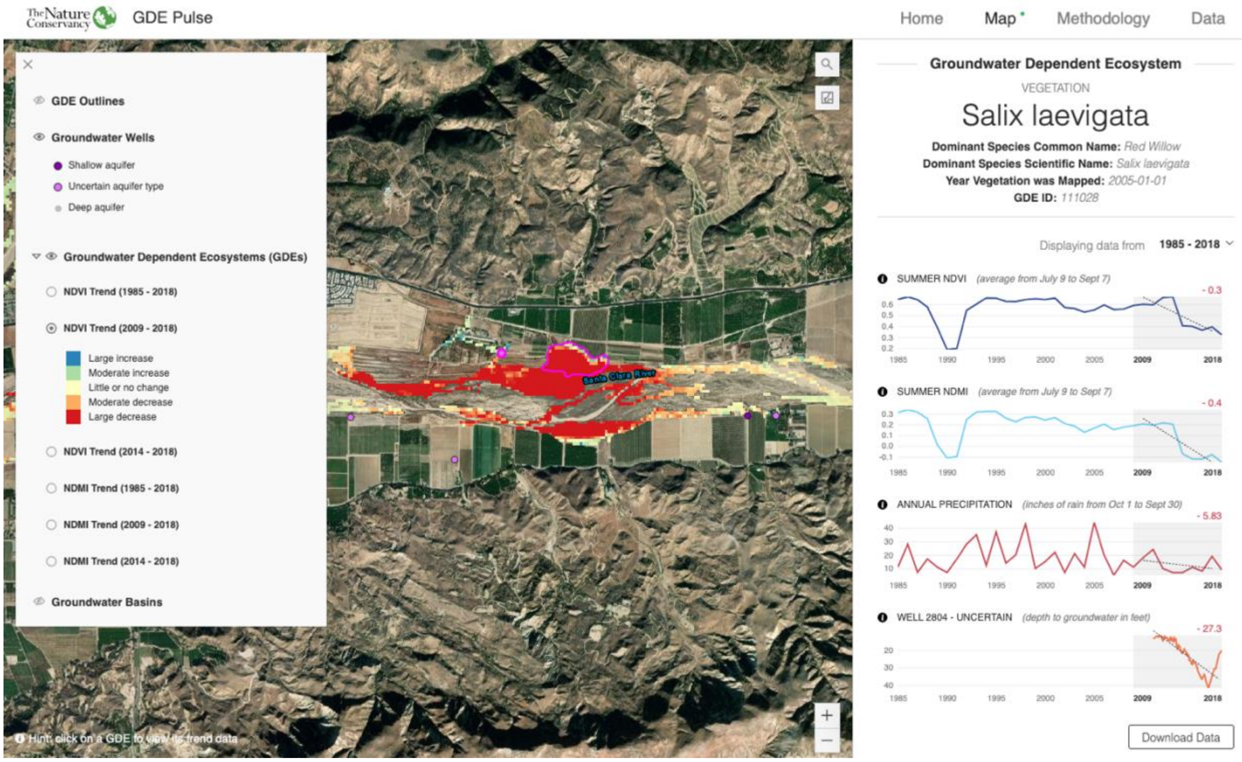
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

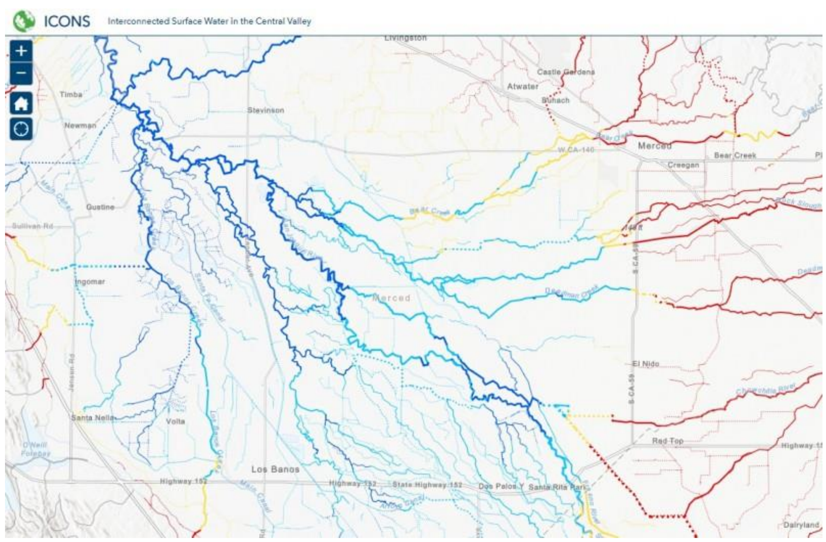
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data [available online](#) from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Colusa Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Colusa Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Candidate - Threatened	Endangered	
Egretta thula	Snowy Egret			
Nycticorax nycticorax	Black-crowned Night-Heron			
Pandion haliaetus	Osprey		Watch list	
Riparia riparia	Bank Swallow		Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Oxyura jamaicensis	Ruddy Duck			

Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta conservatio	Conservancy Fairy Shrimp	Endangered	Special	IUCN - Endangered
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
Hyalella spp.	Hyalella spp.			
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Spirinchus thaleichthys	Longfin smelt	Candidate	Threatened	Vulnerable - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endangered	Endangered	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC

Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Dicamptodon ensatus	California Giant Salamander			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
Pseudacris regilla	Northern Pacific Chorus Frog			
INSECTS & OTHER INVERTS				
Ablabesmyia spp.	Ablabesmyia spp.			
Acentrella insignificans	A Mayfly			
Ambrysus amargosus	Ash Meadows Naucorid			
Ambrysus mormon				Not on any status lists
Ambrysus spp.	Ambrysus spp.			
Anax junius	Common Green Darner			
Apedilum spp.	Apedilum spp.			
Argia lugens	Sooty Dancer			
Baetidae fam.	Baetidae fam.			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Belostomatidae fam.	Belostomatidae fam.			
Caenis latipennis	A Mayfly			
Centroptilum album	A Mayfly			
Centroptilum spp.	Centroptilum spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus anonymus				Not on any status lists
Chironomus spp.	Chironomus spp.			
Cladotanytarsus marki				Not on any status lists
Cladotanytarsus spp.	Cladotanytarsus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corisella decolor				Not on any status lists
Corixidae fam.	Corixidae fam.			

Cricotopus annulator				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus curryi				Not on any status lists
Cryptochironomus spp.	Cryptochironomus spp.			
Dicrotendipes adnilus				Not on any status lists
Dicrotendipes spp.	Dicrotendipes spp.			
Ecdyonurus criddlei	A Mayfly			
Enallagma boreale	Boreal Bluet			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Enochrus spp.	Enochrus spp.			
Ephydridae fam.	Ephydridae fam.			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Gomphidae fam.	Gomphidae fam.			
Harnischia spp.	Harnischia spp.			
Heptagenia adaequata				Not on any status lists
Heptagenia spp.	Heptagenia spp.			
Heptageniidae fam.	Heptageniidae fam.			
Hydrophilidae fam.	Hydrophilidae fam.			
Hydropsyche alternans				Not on any status lists
Hydropsyche californica	A Caddisfly			
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila ajax	A Caddisfly			
Hydroptila spp.	Hydroptila spp.			
Ischnura cervula	Pacific Forktail			
Ischnura perparva	Western Forktail			
Laccobius spp.	Laccobius spp.			
Leptoceridae fam.	Leptoceridae fam.			
Libellula forensis	Eight-spotted Skimmer			
Libellula luctuosa	Widow Skimmer			
Libellula pulchella	Twelve-spotted Skimmer			
Libellulidae fam.	Libellulidae fam.			
Micrasema spp.	Micrasema spp.			
Microchironomus nigrovittatus				Not on any status lists
Microchironomus spp.	Microchironomus spp.			
Mideopsis pumila				Not on any status lists
Mideopsis spp.	Mideopsis spp.			

Nanocladius anderseni				Not on any status lists
Nanocladius spp.	Nanocladius spp.			
Nectopsyche spp.	Nectopsyche spp.			
Oecetis spp.	Oecetis spp.			
Oreodytes abbreviatus				Not on any status lists
Oreodytes spp.	Oreodytes spp.			
Pachydiplax longipennis	Blue Dasher			
Paltothemis lineatipes	Red Rock Skimmer			
Pantala flavescens	Wandering Glider			
Pantala hymenaea	Spot-winged Glider			
Paracladopelma alphaeus				Not on any status lists
Paracladopelma spp.	Paracladopelma spp.			
Parakiefferiella spp.	Parakiefferiella spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Pentaneura spp.	Pentaneura spp.			
Phaenopsectra dyari				Not on any status lists
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum albicorne				Not on any status lists
Polypedilum spp.	Polypedilum spp.			
Procladius barbatulus				Not on any status lists
Procladius spp.	Procladius spp.			
Protochauliodes minimus				Not on any status lists
Protoptila erotica				Not on any status lists
Pseudochironomus spp.	Pseudochironomus spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Serratella micheneri	A Mayfly			
Sigara alternata				Not on any status lists
Sigara mckinstryi	A Water Boatman			Not on any status lists
Sigara spp.	Sigara spp.			
Simulium anduzei				Not on any status lists
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sperchon stellata				Not on any status lists
Sympetrum corruptum	Variegated Meadowhawk			

Sympetrum madidum	Red-veined Meadowhawk			
Tanytarsus angulatus				Not on any status lists
Tanytarsus spp.	Tanytarsus spp.			
Tinodes belisus	A Caddisfly			
Tipulidae fam.	Tipulidae fam.			
Tramea lacerata	Black Saddlebags			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
Unionicolidae fam.	Unionicolidae fam.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Ferrissia spp.	Ferrissia spp.			
Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus spp.	Gyraulus spp.			
Helisoma spp.	Helisoma spp.			
Lymnaea spp.	Lymnaea spp.			
Lymnaeidae fam.	Lymnaeidae fam.			
Margaritifera falcata	Western Pearlshell		Special	
Menetus opercularis	Button Sprite			CS
Menetus spp.	Menetus spp.			
Physa spp.	Physa spp.			
Planorbidae fam.	Planorbidae fam.			
PLANTS				
Chloropyron palmatum	NA	Endangered	Special	CRPR - 1B.1
Orcuttia pilosa	Hairy Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Puccinellia simplex	Little Alkali Grass			
Tuctoria greenei	Green's Awnless Orcutt Grass	Endangered	Rare	CRPR - 1B.1
Alnus rhombifolia	White Alder			
Alopecurus carolinianus	Tufted Foxtail			
Alopecurus pratensis	NA			
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Ammannia robusta	Grand Redstem			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			

Azolla filiculoides	NA			
Azolla microphylla	Mexican mosquito fern		Special	CRPR - 4.3
Baccharis salicina				Not on any status lists
Bacopa eisenii	Gila River Water-hyssop			
Bacopa rotundifolia	NA			
Bergia texana	Texas Bergia			
Boehmeria cylindrica	NA			Not on any status lists
Bolboschoenus fluviatilis				Not on any status lists
Bolboschoenus glaucus	NA			Not on any status lists
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Brasenia schreberi	Watershield		Special	CRPR - 2B.3
Brodiaea nana				Not on any status lists
Calamagrostis nutkaensis	Pacific Small-reedgrass			
Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche heterophylla heterophylla	Northern Water-starwort			
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Callitriche trochlearis	Waste-water Water-starwort			
Calochortus uniflorus	Shortstem Mariposa Lily		Special	CRPR - 4.2
Carex densa	Dense Sedge			
Carex feta	Green-sheath Sedge			
Carex nudata	Torrent Sedge			
Carex obnupta	Slough Sedge			
Carex vulpinoidea	NA			
Castilleja minor minor	Alkali Indian-paintbrush			
Cephalanthus occidentalis	Common Buttonbush			
Cicendia quadrangularis	Oregon Microcala			
Cirsium douglasii breweri				Not on any status lists
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Crypsis vaginiflora	NA			
Cyperus acuminatus	Short-point Flatsedge			
Cyperus erythrorhizos	Red-root Flatsedge			

Cyperus fuscus	NA			
Cyperus iria	NA			Not on any status lists
Cyperus squarrosus	Awned Cyperus			
Damasonium californicum				Not on any status lists
Datisca glomerata	Durango Root			
Delphinium uliginosum	Swamp Larkspur		Special	CRPR - 4.2
Downingia bella	Hoover's Downingia			
Downingia bicornuta	NA			
Downingia concolor	NA			
Downingia cuspidata	Toothed Calicoflower			
Downingia insignis	Parti-color Downingia			
Downingia ornatissima	NA			
Downingia pulchella	Flat-face Downingia			
Downingia yina	NA			
Echinochloa oryzoides	NA			
Echinodorus berteroi	Upright Burhead			
Elatine californica	California Waterwort			
Elatine heterandra	Mosquito Waterwort			
Elatine rubella	Southwestern Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis atropurpurea	Purple Spikerush			
Eleocharis bella	Delicate Spikerush			
Eleocharis coloradoensis				Not on any status lists
Eleocharis engelmannii engelmannii	Engelmann's Spikerush			Not on any status lists
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Eleocharis obtusa	Blunt Spikerush			
Eleocharis parishii	Parish's Spikerush			
Eleocharis quadrangulata	NA			
Eleocharis quinqueflora	Few-flower Spikerush			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eragrostis hypnoides	Teal Lovegrass			
Eryngium aristulatum aristulatum	California Eryngo			
Eryngium articulatum	Jointed Coyote-thistle			
Eryngium castrense	Great Valley Eryngo			
Eryngium jepsonii	NA			Not on any status lists

Eryngium vaseyi vallicola				Not on any status lists
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euphorbia hooveri	NA			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Fimbristylis autumnalis	NA			
Gratiola ebracteata	Bractless Hedge-hyssop			
Hastingsia alba	White Rushlily			
Helenium bigelovii	Bigelow's Sneezeweed			
Helenium puberulum	Rosilla			
Heteranthera limosa	NA			
Hydrocotyle ranunculoides	Floating Marsh-pennywort			
Hydrocotyle umbellata	Many-flower Marsh-pennywort			
Isoetes howellii	NA			
Isoetes nuttallii	NA			
Isolepis cernua	Low Bulrush			
Juncus acuminatus	Sharp-fruit Rush			
Juncus articulatus articulatus				Not on any status lists
Juncus diffusissimus	NA			
Juncus effusus effusus	NA			
Juncus effusus pacificus				
Juncus uncialis	Inch-high Rush			
Juncus usitatus	NA			Not on any status lists
Juncus xiphioides	Iris-leaf Rush			
Lasthenia ferrisiae	Ferris' Goldfields		Special	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lemna aequinoctialis	Lesser Duckweed			
Lemna gibba	Inflated Duckweed			
Lemna minor	Lesser Duckweed			
Lemna minuta	Least Duckweed			
Lemna turionifera	Turion Duckweed			
Lepidium oxycarpum	Sharp-pod Pepper-grass			
Limnanthes alba alba	White Meadowfoam			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limnanthes douglasii nivea	Douglas' Meadowfoam			
Limnanthes douglasii rosea	Douglas' Meadowfoam			

Limnanthes floccosa californica	Shippee Meadowfoam	Endangered	Endangered	CRPR - 1B.1
Limosella acaulis	Southern Mudwort			
Limosella aquatica	Northern Mudwort			
Lipocarpha micrantha	Dwarf Bulrush			
Ludwigia grandiflora	NA			
Ludwigia hexapetala	NA			Not on any status lists
Ludwigia palustris	Marsh Seedbox			
Ludwigia peploides montevidensis	NA			Not on any status lists
Ludwigia peploides peploides	NA			Not on any status lists
Lycopus americanus	American Bugleweed			
Lythrum californicum	California Loosestrife			
Lythrum portula	NA			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus tricolor	Tricolor Monkeyflower			
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Myriophyllum aquaticum	NA			
Myriophyllum hippuroides	Western Water-milfoil			
Najas gracillima	NA			
Najas guadalupensis guadalupensis	Southern Naiad			
Navarretia cotulifolia	Cotula Navarretia			
Navarretia heterandra	Tehama Navarretia			
Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala bakeri	Baker's Navarretia		Special	CRPR - 1B.1
Navarretia leucocephala leucocephala	White-flower Navarretia			
Navarretia leucocephala minima	Least Navarretia			
Orcuttia tenuis	Slender Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Oxypolis occidentalis	Western Cowbane			
Panicum dichotomiflorum	NA			
Paspalum distichum	Joint Paspalum			
Perideridia bolanderi involucrata	Bolander's Yampah			
Perideridia kelloggii	Kellogg's Yampah			
Perideridia oregana	Oregon Yampah			
Persicaria hydropiper	NA			Not on any status lists
Persicaria hydropiperoides				Not on any status lists

Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phacelia distans	NA			
Phragmites australis australis	Common Reed			
Phyla lanceolata	Fog-fruit			
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys austiniae	Austin's Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pogogyne douglasii	NA			
Pogogyne zizyphoroides				Not on any status lists
Potamogeton diversifolius	Water-thread Pondweed			
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton gramineus	Grassy Pondweed			
Potamogeton nodosus	Longleaf Pondweed			
Potamogeton pusillus pusillus	Slender Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus brevissimus multiflorus	Delta Woolly Marbles		Special	CRPR - 4.2
Psilocarphus oregonus	Oregon Woolly-heads			
Psilocarphus tenellus	NA			
Puccinellia nuttalliana	Nuttall's Alkali Grass			
Ranunculus bonariensis	NA			
Ranunculus pusillus pusillus	Pursh's Buttercup			
Ranunculus sceleratus	NA			
Rhododendron occidentale occidentale	Western Azalea			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			

Rorippa palustris palustris	Bog Yellowcress			
Rotala ramosior	Toothcup			
Rumex conglomeratus	NA			
Rumex salicifolius salicifolius	Willow Dock			
Rumex stenophyllus	NA			
Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Sagittaria longiloba	Longbarb Arrowhead			
Sagittaria montevidensis calycina				Not on any status lists
Sagittaria sanfordii	Sanford's Arrowhead		Special	CRPR - 1B.2
Salix babylonica	NA			
Salix breweri	Brewer's Willow			
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix lutea	Yellow Willow			
Salix melanopsis	Dusky Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus americanus	Three-square Bulrush			
Schoenoplectus pungens pungens	NA			
Schoenoplectus tabernaemontani	Softstem Bulrush			
Sequoia sempervirens				
Sidalcea hirsuta	Hairy Checker-mallow			
Sidalcea oregana hydrophila	Water-loving Checker-mallow		Special	CRPR - 1B.2
Sinapis alba	NA			
Sparganium eurycarpum eurycarpum				
Spirodela polyrhiza	NA			
Stachys ajugoides	Bugle Hedge-nettle			
Stachys albens	White-stem Hedge-nettle			
Stachys pycnantha	Short-spike Hedge-nettle			
Stachys stricta	Sonoma Hedge-nettle			
Stuckenia pectinata				Not on any status lists
Suaeda calceoliformis	American Sea-blite			
Symphyotrichum lentum	Suisun Marsh Aster		Special	CRPR - 1B.2

Toxicoscordion micranthum	NA			Not on any status lists
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Utricularia gibba	Humped Bladderwort			
Veronica anagallis-aquatica	NA			
Veronica catenata	NA			Not on any status lists
Wolffia borealis	Dotted Watermeal			
Wolffia brasiliensis	Pointed Watermeal		Special	CRPR - 2B.3
Wolffia globosa	Asian Watermeal			
Wolffiella oblonga	Saber-shape Bogmat			
Zannichellia palustris	Horned Pondweed			
Zizania palustris palustris	NA			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

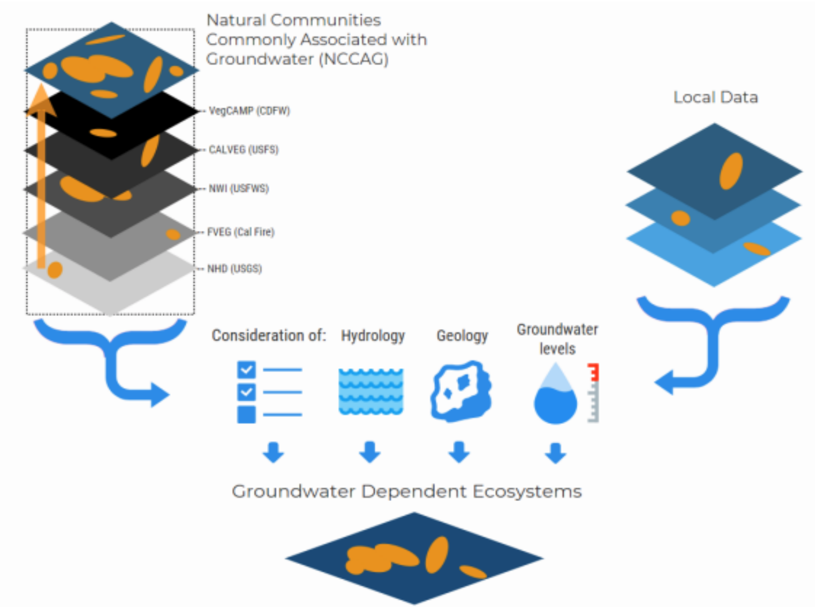


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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3 For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
4 "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
5 The Groundwater Resource Hub: www.GroundwaterResourceHub.org

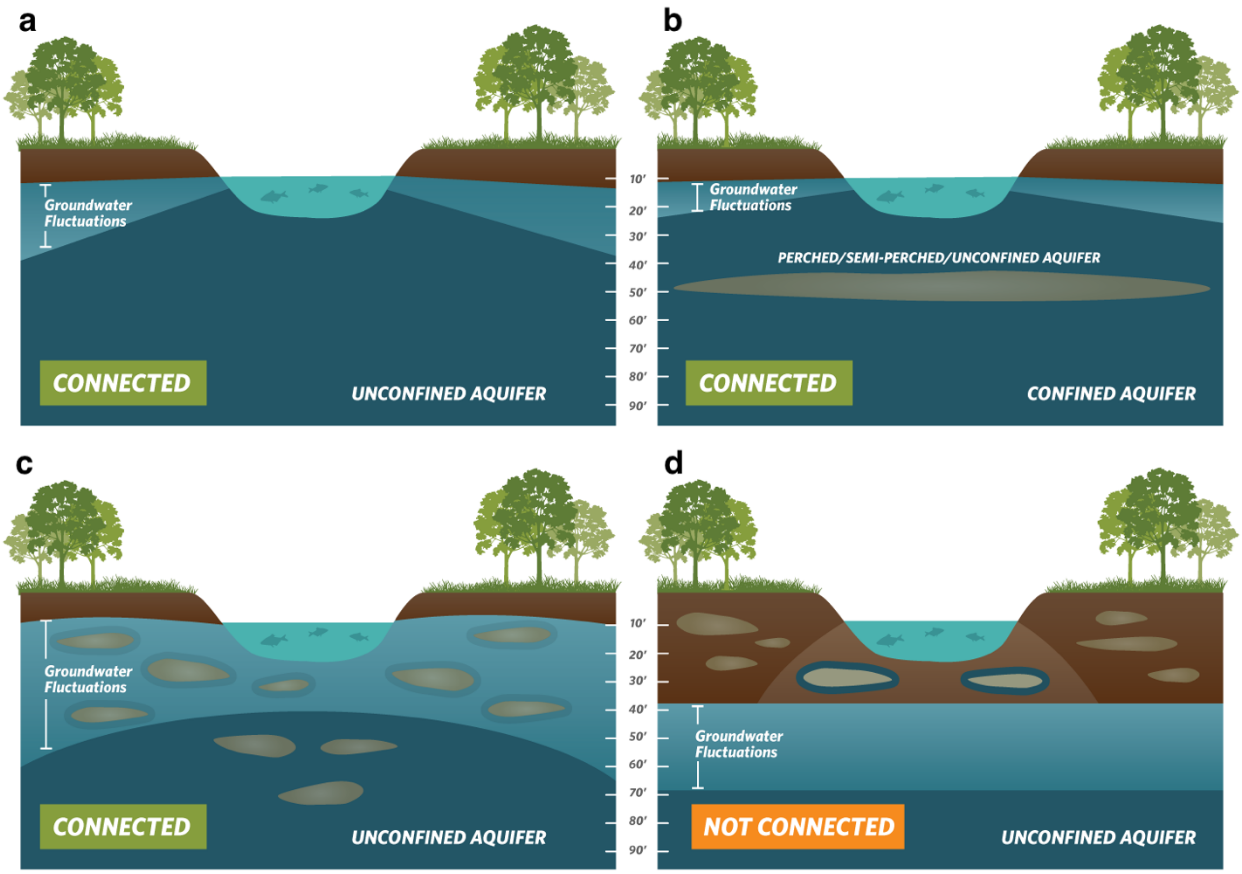

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

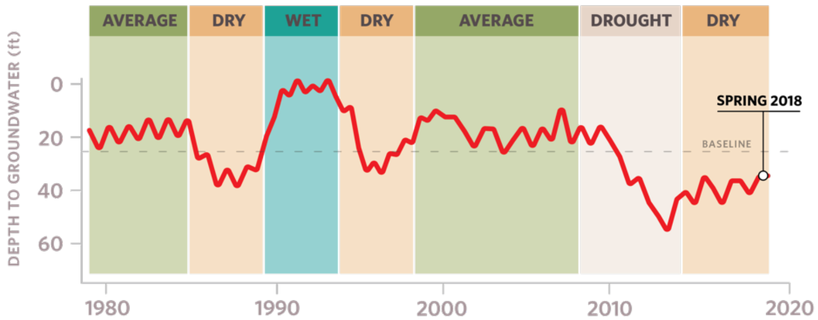

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

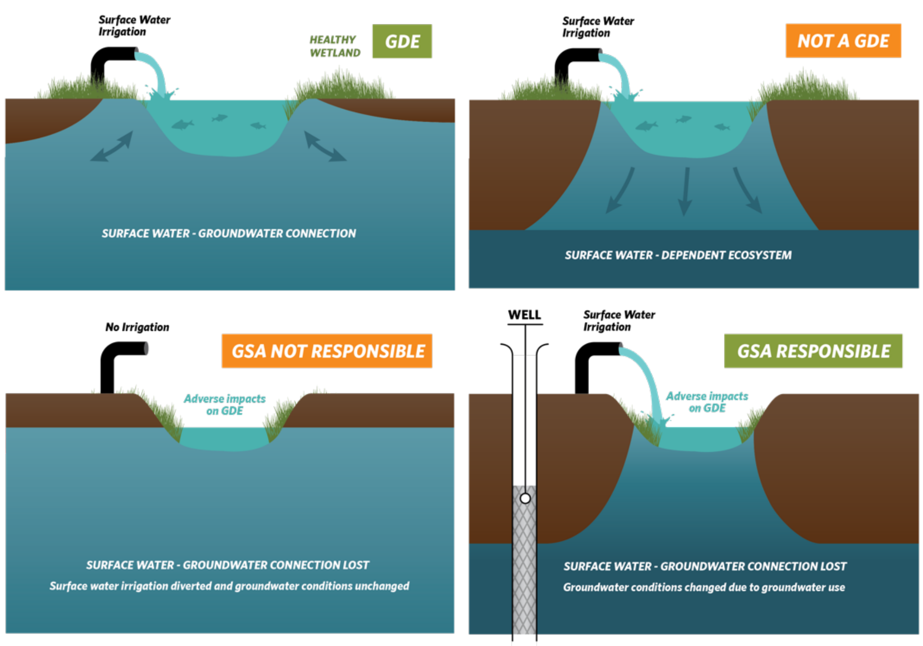

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

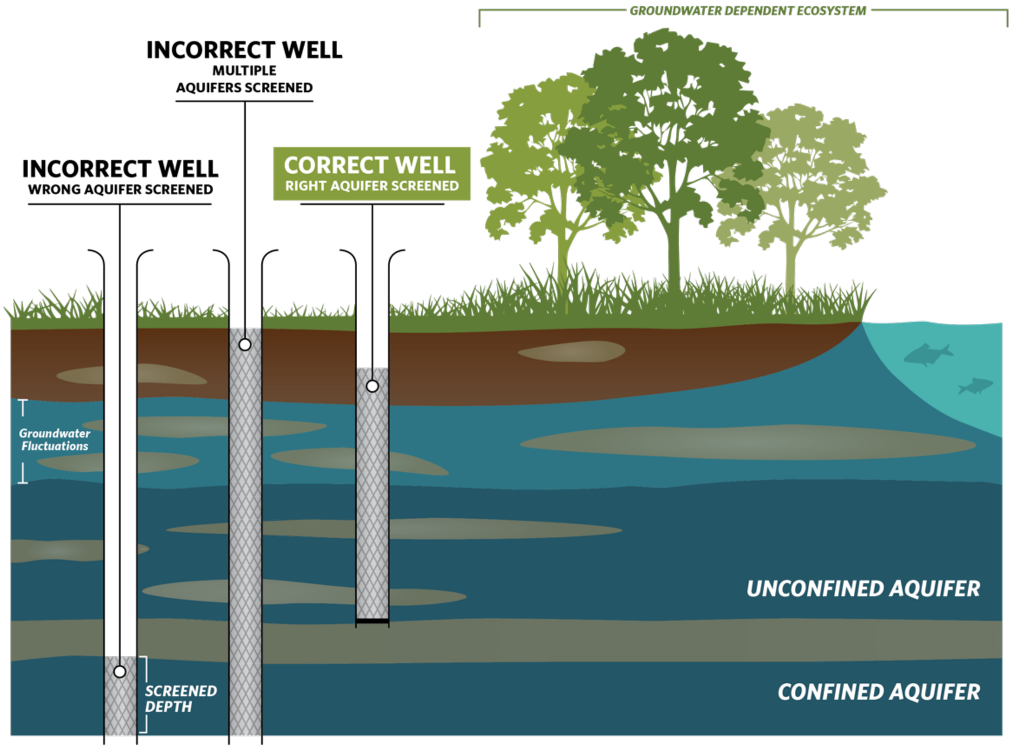

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

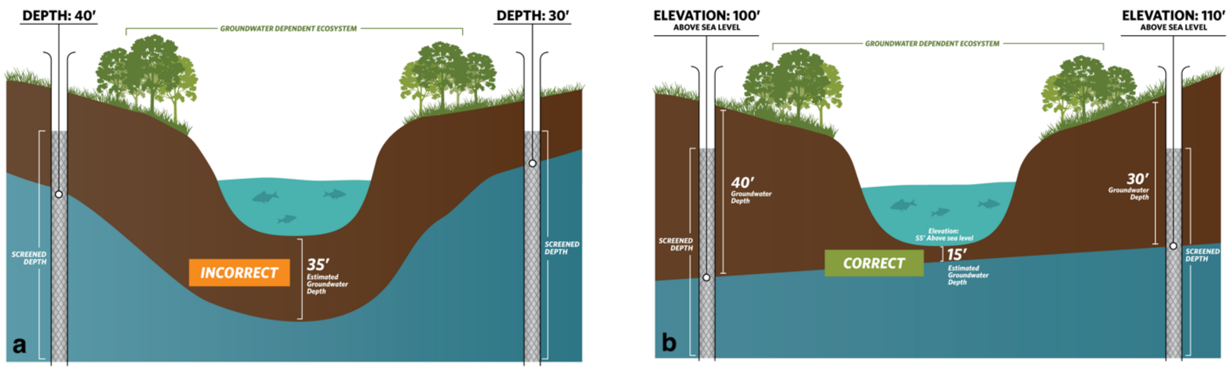

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

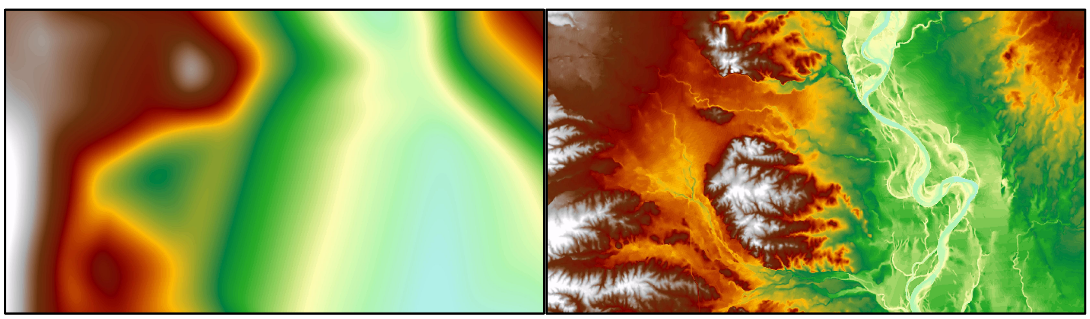

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

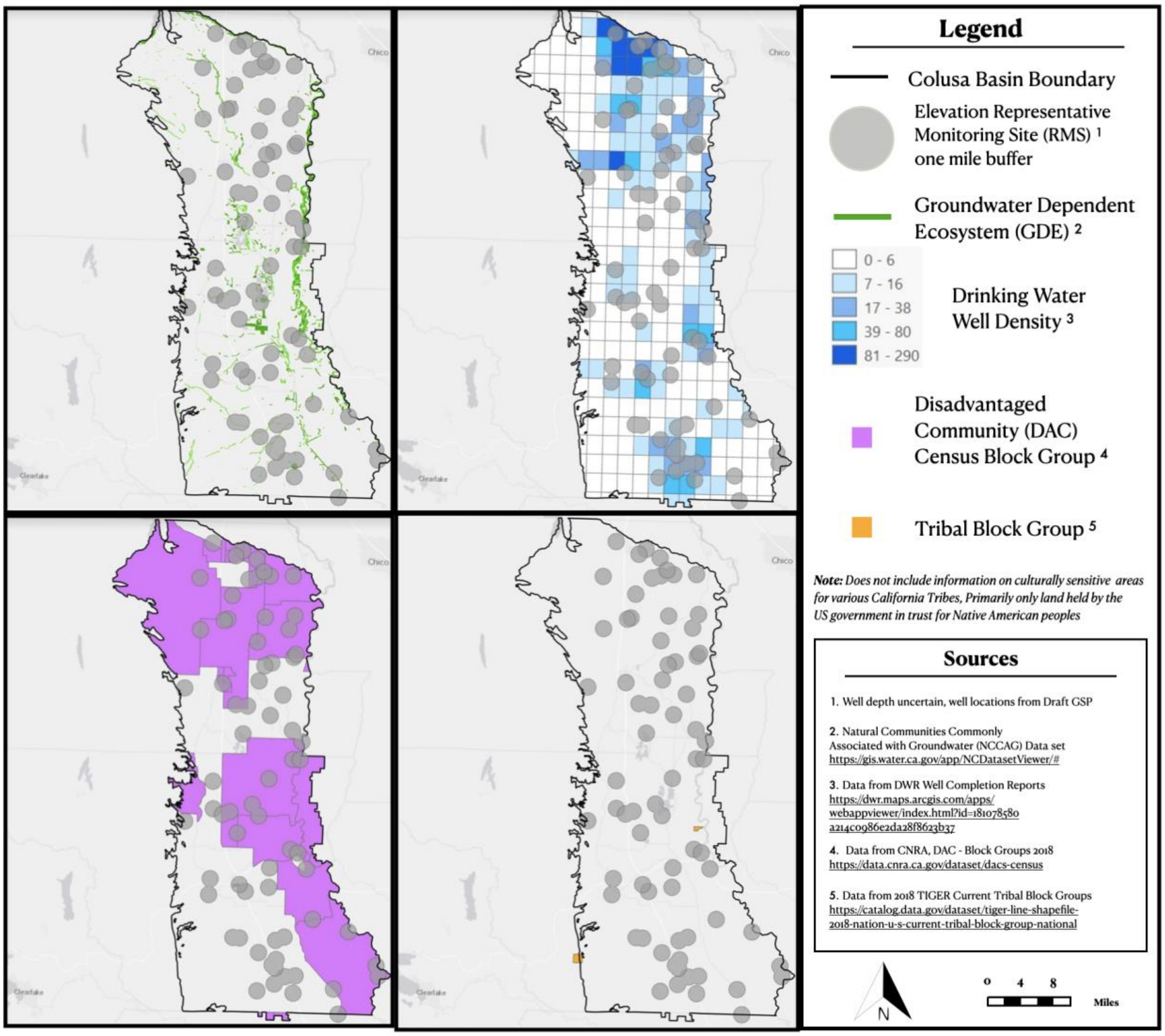

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

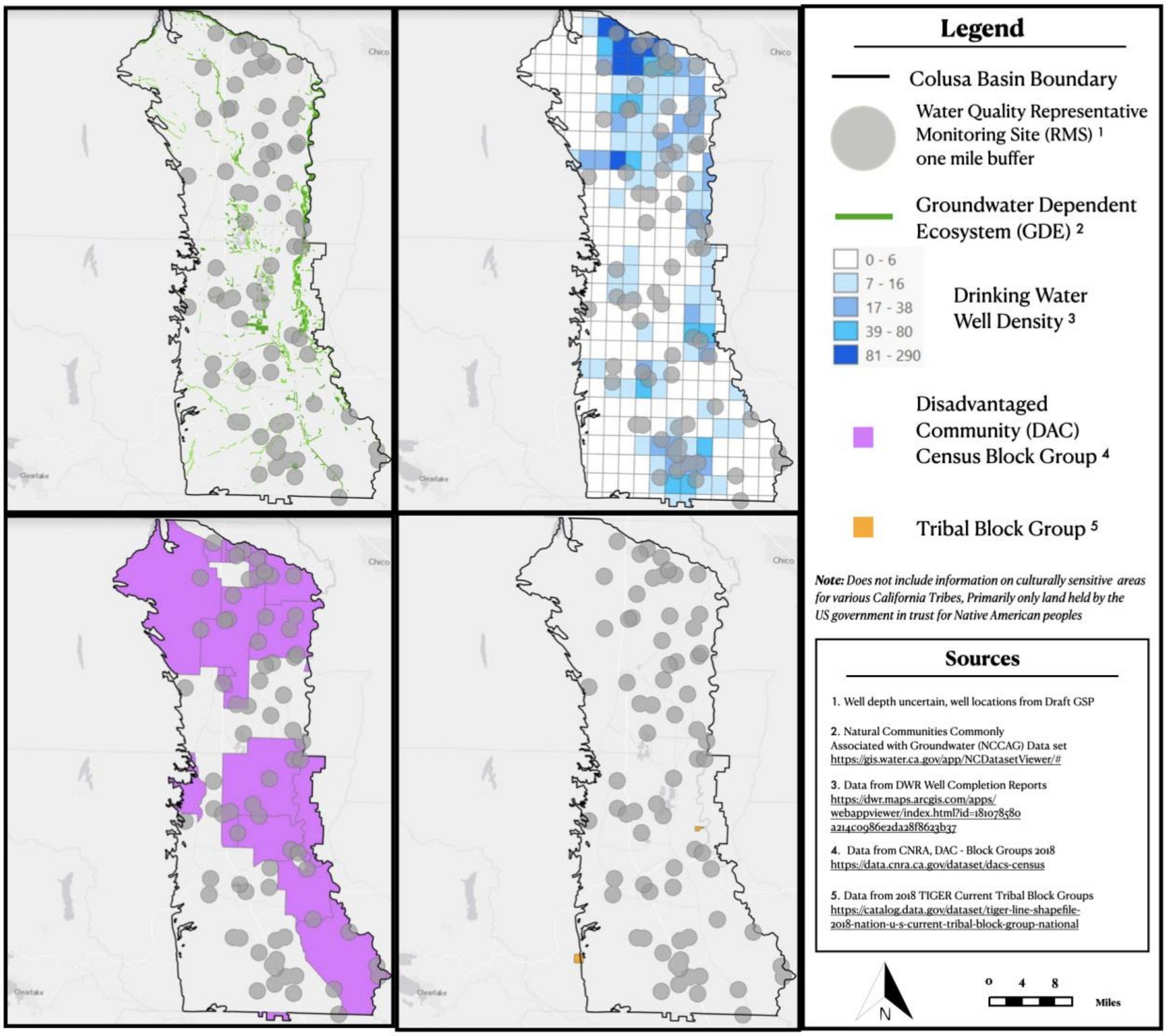

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

October 25, 2021

Tehama County Flood Control and Water Conservation District GSA
9380 San Benito Ave
Gerber, CA 96035

Submitted via email: nbethurem@tcpw.ca.gov; lhunter@countyofglenn.net

Re: Public Comment Letter for Corning Subbasin Draft GSP

Dear Nicole Bethurem,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Corning Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Corning Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring points in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Corning Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. The GSP provides information on DACs, including identification by name and location on a map. However, the GSP fails to document the size of the population for each DAC, and include the population dependent on groundwater as their source of drinking water in the subbasin.

The GSP states (p. 2-26): "The Paskenta Band has jurisdiction over the Paskenta Reservation (Tribal Lands). This approximately 2,000-acre Reservation is located in the center of the Subbasin, southwest of the City of Corning and is completely reliant on groundwater for drinking water and irrigation supplies." The GSP does not, however, provide a map of tribal lands in the subbasin or state the tribal population.

While the plan provides a density map of domestic wells in the subbasin, the GSP fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide a map of tribal lands in the subbasin. • Describe the population of each identified DAC and identify the sources of drinking water for DAC members, including an estimate of how many people rely on

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

groundwater (e.g., domestic wells, state small water systems, and public water systems).

- Include a map showing domestic well locations and average well depth across the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. To assess ISWs, the North Sacramento IWFM Model (NSac) was used. The GSP lacked a clear summary of the locations of groundwater wells and their screen depths used in the analysis, and description of temporal (seasonal and interannual) variability of the data used to calibrate the model. This information should be provided in the GSP to support the conclusions presented. Additionally, no analysis or discussion is provided for stream reaches in the interior of the subbasin.

The GSP is not clear regarding its conclusions about connectivity of Thomes Creek. Certain reaches shown on Figure 3-53 are connected for some percentage of time. The GSP states (p. 3-109): "*There is not enough groundwater level data, particularly along Thomes Creek, to know with certainty if and when groundwater and surface water are interconnected.*" We recommend that reaches with data gaps are retained as potential ISWs in the GSP.

We commend the GSAs for confirming the results of the ISW analysis with TNC's Interconnected Surface Water in the Central Valley (ICONS) website, as presented on Figure 3-54 of the GSP.[2]

RECOMMENDATIONS

- Further describe the groundwater elevation data and stream flow data used in the modeling analysis. Discuss screening depth of monitoring wells and ensure they are monitoring the shallow principal aquifer. Discuss temporal (seasonal and interannual) variability of the data used to calibrate the model.

- Discuss stream reaches in the interior of the subbasin. For example, discuss whether they were included in the groundwater model and discuss relevant depth to groundwater data. Clearly state that they are considered to be disconnected, if that is the case, and what data was utilized to support that conclusion.

- To confirm the results of the groundwater modeling analysis, overlay the stream reaches shown with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

[2]Available online at: https://icons.codefornature.org/

- Describe data gaps for the ISW analysis in the ISW section, in addition to the discussion in Section 5 (Monitoring Network). On the ISW map (Figure 3-53), clearly label the areas with data gaps. While the GSP identifies data gaps and their locations in the text, we recommend that the GSP considers any segments with data gaps as potential ISWs and clearly marks them as such on maps provided in the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, we found that some mapped features in the NC dataset were improperly disregarded due to lack of data. The GSP states (p. 3-119): *"GDE extent in general is not well refined in the Subbasin and is a data gap that will be addressed during GSP implementation with additional data collection and ground-truthing. For example, Thomes Creek does not have enough shallow groundwater level monitoring to evaluate changes in groundwater levels relative to GDE vegetation vigor."* However, the GSP should not ignore these GDEs just because there is a lack of data to support their characterization. The absence of evidence is not the evidence of absence.

The GSP does not present an inventory of flora and fauna species present in the subbasin's GDEs, except for critical and threatened species in the subbasin that rely on GDEs (Table 3-10).

The GSP states (p. 3-119): *"There is some evidence that the deepest roots of valley oaks and possibly other mature GDE species can reach depths up to 80 feet, though most vegetative species do not have this capacity, and it is not known if rooting depths deeper than 30 feet are found in the Subbasin."* Without an inventory of flora species in the subbasin's GDEs, however, it is impossible to know if these deep-rooted species are present in the subbasin.

Data from spring 2018 was used to map the 30-foot depth-to-water contour shown on Figure 3-58. Even though the GSP points out that this is conservative because 2018 was a wet year, we recommend using groundwater data from multiple seasons and water year types to determine the range of depth to groundwater around NC dataset polygons.

RECOMMENDATIONS

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as valley oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used, if these species are present in the subbasin. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- Include an inventory of the fauna and flora present within the subbasin's GDEs (see Attachment C of this letter for a list of freshwater species located in the Corning Subbasin).

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[3,4] The integration of these ecosystems into the water budget is **insufficient**. The water budget did explicitly include the current, historical, and projected demands of native vegetation, but did not explicitly include the current, historical, and projected demands of managed wetlands. The GSP states that managed wetlands exist along the Sacramento River and are managed by the Sacramento River National Wildlife Refuge. The omission of explicit water demands for managed wetlands is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

RECOMMENDATION

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including managed wetlands.

[3] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[4] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

B. Engaging Stakeholders

Stakeholder Engagement during GSP development
Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Communications and Engagement Plan (Appendix 2A).[5]

We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement with DACs, domestic well owners, and environmental stakeholders are described in very general terms. There are no details of outreach specifically directed to members of these stakeholder communities in the GSP.

- The Communications and Engagement Plan does not include specific plans during the implementation phase that differ from the GSP development phase for continual engagement with DACs, tribes, domestic well owners, and environmental stakeholders.

RECOMMENDATION

- In the Communications and Engagement Plan, describe active and targeted outreach to engage DAC members, domestic well owners, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the subbasin within the GSP.[6]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[7,8,9]

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[5] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]
[6] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf
[7] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
[8] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[9] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP presents an analysis of minimum thresholds impact on domestic wells (p. 6-20). The GSP states (p. 6-21): "*When intersecting the groundwater elevation contours at the minimum threshold for shallow RMPs with the domestic wells, approximately 16% of domestic wells are at risk of getting impacted (Figure 6-6* [Domestic Wells at Risk of being Impacted if Groundwater Levels Reach Minimum Thresholds]*). As a comparison, fall 2015 groundwater elevation intersected with domestic wells depths showed approximately 4% of domestic wells potentially dry, excluding a large data gap area to the west (Figure 6-7* [Domestic Wells that Likely were Impacted During 2015 Drought]*).*" Despite this well impact analysis, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users in those 16% not protected by the MT, and whether the undesirable results are consistent with Human Right to Water policy.[10]

The GSP does not sufficiently describe or analyze direct or indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, nor does it describe how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results to DACs, drinking water users, or tribes in the subbasin.

The GSP provides conflicting information regarding constituents of concern (COCs) in the subbasin. The GSP states (p. 3-94): *"Constituents identified as groundwater quality concerns within the Subbasin are identified in the bullets below and summarized in the following subsections: Salinity (EC and TDS), Nitrate, Arsenic."* However, the GSP states (p. 6-39): "*Salinity was identified as the only COC in the Subbasin. Therefore, TDS will be used as a salinity indicator to measure groundwater quality in the Subbasin to assess potential effects of GSP implementation."* The minimum threshold for TDS is set to 750 mg/L, lower than the upper limit secondary maximum contaminant level (SMCL) of 1,000 mg/L. SMC should be established for the additional identified COCs in the subbasin, including nitrate and arsenic.

The GSP only includes a very general discussion of impacts to drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs, drinking water users, or tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs, drinking water users, or tribes.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality. For specific guidance on how to

[10] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

consider these users, refer to “Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act.”[11]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin. Ensure they align with drinking water standards.[12]

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP only considers GDEs with respect to the depletion of interconnected surface water sustainability indicator, but not the chronic lowering of groundwater levels sustainability indicator. No analysis or discussion is provided in the GSP that describes impacts on GDEs or establishes SMC for GDEs that are directly dependent on groundwater. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC for chronic lowering of groundwater levels. The GSP mentions, but does not further discuss, the potential impact on GDEs (p. 6-28): *“Since groundwater elevation minimum thresholds near interconnected streams are lower than current groundwater elevations, there may be some impacts on GDEs in the Subbasin.”*

Sustainable management criteria for depletion of interconnected surface water are established by proxy using groundwater levels. Groundwater level minimum thresholds were established in depletion of interconnected surface water RMP wells near interconnected stream reaches. The GSP states (6-60): *“Since the shallow wells near the streams were categorized as stable wells in the chronic lowering of groundwater levels SMC, the minimum threshold at these wells is the minimum fall groundwater elevation since 2012 minus a 20-foot buffer.”* However, no analysis or discussion is presented to describe how the SMC will affect GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- Define chronic lowering of groundwater SMC directly for environmental beneficial users of groundwater. When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact on GDEs. Undesirable results to environmental users occur when ‘significant and unreasonable’ effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or

[11] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[12] “Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues.” [23 CCR §354.34(c)(4)]

depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin.[13] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[14]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[15] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,16]

- When establishing SMC for the basin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[17] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[18] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[19] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

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[13] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[14] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[15] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[16] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[17] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[18] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[19] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

The sustainable yield is calculated based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, tribes, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, tribes, GDEs, and ISWs in the subbasin.

Figure 5-2 (Shallow Groundwater RMP Well Locations) and Figure 5-8 (Groundwater Quality RMP Well Locations) show that no monitoring wells are located across portions of the subbasin near DACs, domestic wells, and tribes (see maps provided in Attachment E). Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[20]

The GSP provides some discussion of data gaps for GDEs and ISWs in Sections 5.2.6 (Groundwater Level Monitoring Data Gaps) and Section 5.6.3 (Interconnected Surface Water Monitoring Data Gaps), however does not provide specific plans, such as locations or a timeline, to fill the data gaps.

[20] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

RECOMMENDATION
● Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, tribes, GDEs, and ISWs to clearly identify potentially impacted areas. ● Increase the number of RMPs in the shallow aquifer across the subbasin as needed to adequately monitor all groundwater condition indicators across the basin and at appropriate depths. Prioritize proximity to DACs, domestic wells, tribes, and GDEs when identifying new RMPs.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, tribes, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

We commend the GSAs for including several projects and management actions with explicit benefits to the environment (e.g., Priority Project 3: Invasive Plant Removal, Priority Project 4: Groundwater Recharge through Unlined Conveyance Features). Additionally, the GSP includes a drinking water well mitigation program (Management Action 1: Well Management Program) to protect drinking water users.

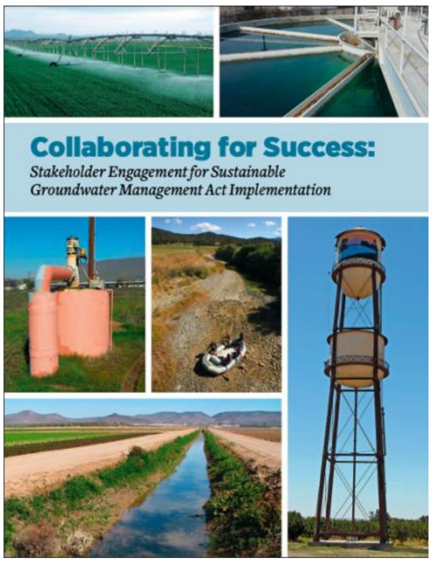
RECOMMENDATIONS
● For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts. ● The GSP discusses potential options for additional surface water storage. Note that recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the “Multi-Benefit Recharge Project Methodology Guidance Document.”[21] ● Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[21] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



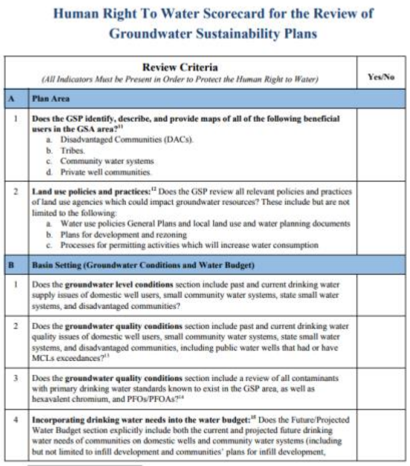
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

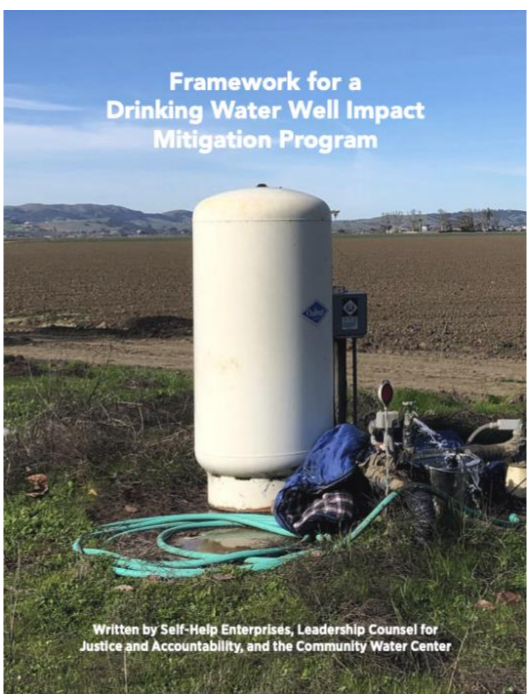
The Human Right to Water


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

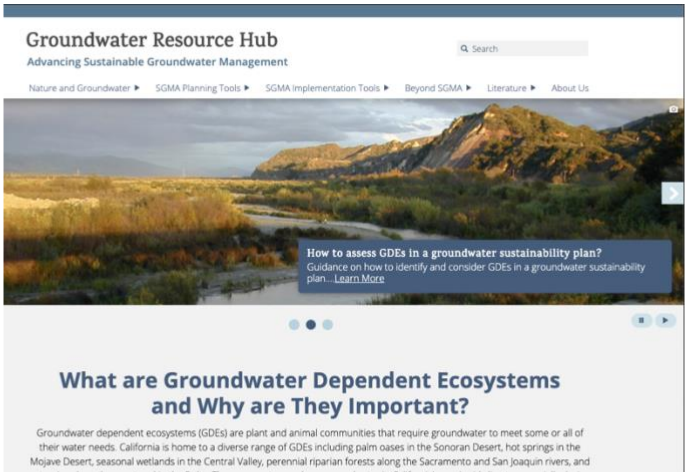
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



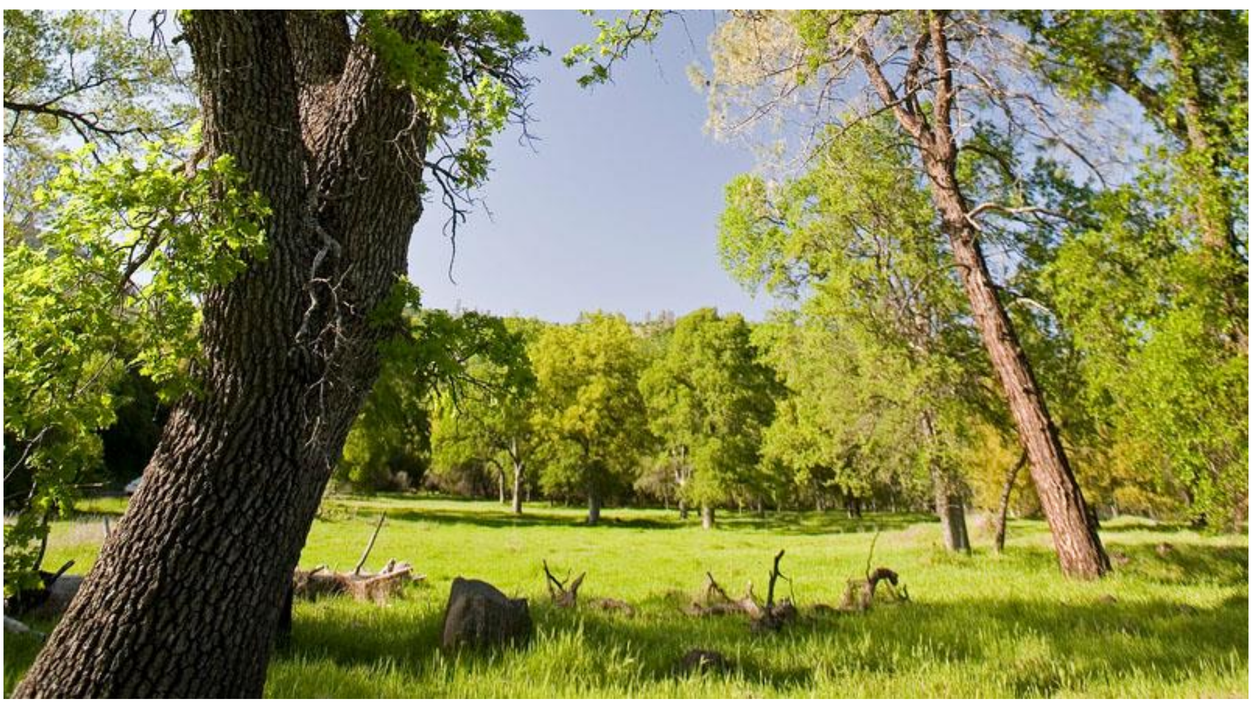
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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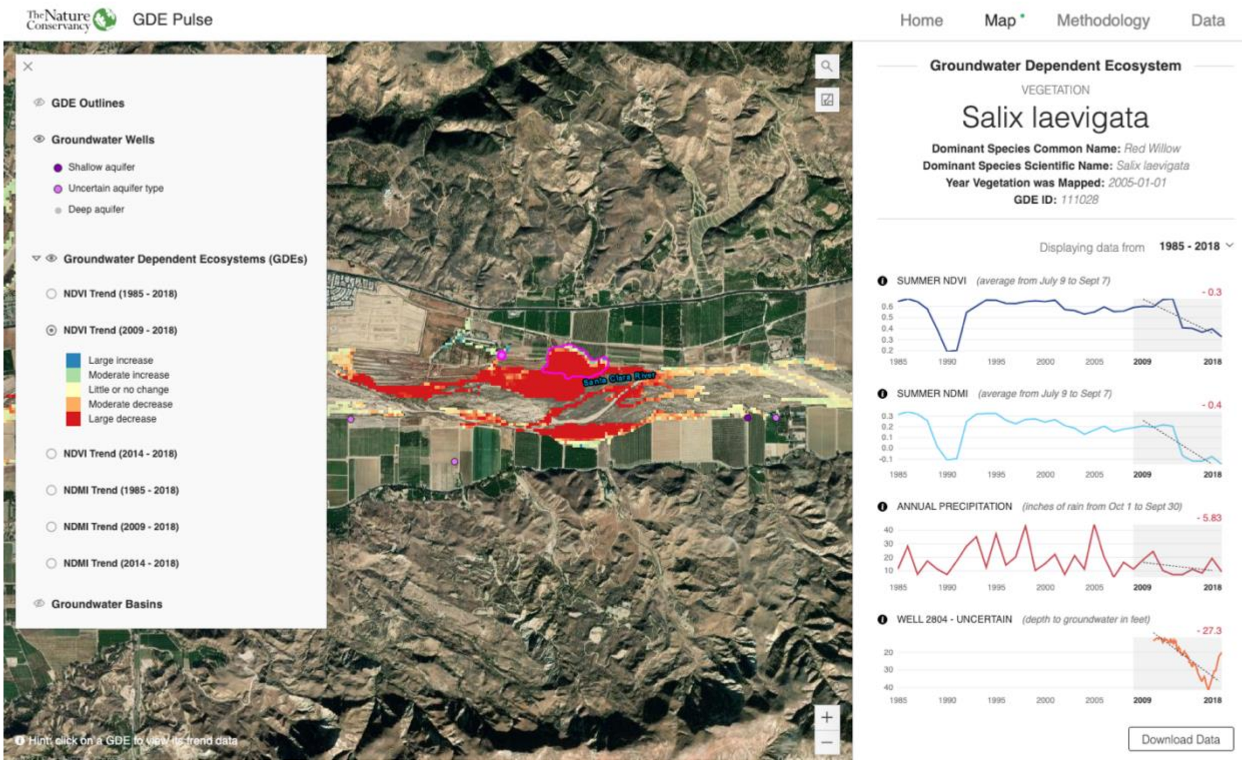
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](https://gde.codefornature.org) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

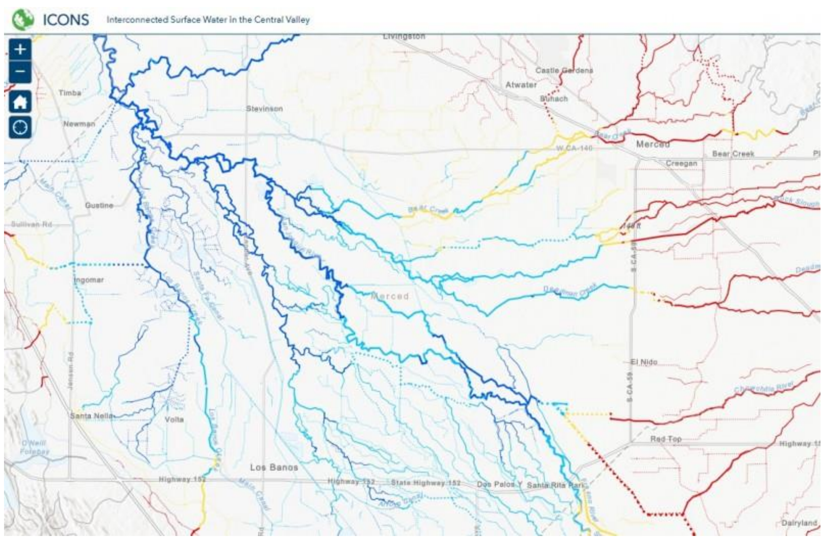
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Corning Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Corning Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Candidate - Threatened	Endangered	
Riparia riparia	Bank Swallow		Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			

Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endangered	Endangered	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or	Special Concern	ARSSC

		Petition Process		
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
Pseudacris regilla	Northern Pacific Chorus Frog			
INSECTS & OTHER INVERTS				
Anax junius	Common Green Darner			
Argia emma	Emma's Dancer			
Argia lugens	Sooty Dancer			
Sympetrum corruptum	Variegated Meadowhawk			
Tramea lacerata	Black Saddlebags			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Gonidea angulata	Western Ridged Mussel		Special	
Margaritifera falcata	Western Pearlshell		Special	
PLANTS				
Downingia pusilla	Dwarf Downingia		Special	CRPR - 2B.2
Alisma triviale	Northern Water-plantain			
Alopecurus saccatus	Pacific Foxtail			
Ammannia robusta	Grand Redstem			
Arundo donax	NA			
Azolla filiculoides	NA			
Baccharis salicina				Not on any status lists
Bergia texana	Texas Bergia			
Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche heterophylla heterophylla	Northern Water-starwort			
Callitriche marginata	Winged Water-starwort			
Carex densa	Dense Sedge			
Carex vulpinoidea	NA			
Cicendia quadrangularis	Oregon Microcala			
Crassula aquatica	Water Pygmyweed			
Crypsis vaginiflora	NA			

Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus squarrosus	Awned Cyperus			
Downingia bella	Hoover's Downingia			
Downingia cuspidata	Toothed Calicoflower			
Echinodorus berteroi	Upright Burhead			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis radicans	Rooted Spikerush			
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eragrostis hypnoides	Teal Lovegrass			
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Gratiola ebracteata	Bractless Hedge-hyssop			
Gratiola heterosepala	Boggs Lake Hedge-hyssop		Endangered	CRPR - 1B.2
Hypericum anagalloides	Tinker's-penny			
Isoetes howellii	NA			
Juncus acuminatus	Sharp-fruit Rush			
Juncus uncialis	Inch-high Rush			
Lasthenia fremontii	Fremont's Goldfields			
Legenere limosa	False Venus'-looking-glass		Special	CRPR - 1B.1
Lemna minor	Lesser Duckweed			
Ludwigia peploides peploides	NA			Not on any status lists
Marsilea vestita vestita	NA			Not on any status lists
Mimulus pilosus				Not on any status lists
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Navarretia heterandra	Tehama Navarretia			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Navarretia leucocephala minima	Least Navarretia			
Persicaria amphibia				Not on any status lists
Phyla lanceolata	Fog-fruit			
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys austiniae	Austin's Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			

Plagiobothrys leptocladus	Alkali Popcorn-flower			
Pleuropogon californicus californicus				Not on any status lists
Pogogyne douglasii	NA			
Pogogyne zizyphoroides				Not on any status lists
Potamogeton nodosus	Longleaf Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Sagittaria longiloba	Longbarb Arrowhead			
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Sidalcea hirsuta	Hairy Checker-mallow			
Stachys stricta	Sonoma Hedge-nettle			
Typha latifolia	Broadleaf Cattail			
Zannichellia palustris	Horned Pondweed			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

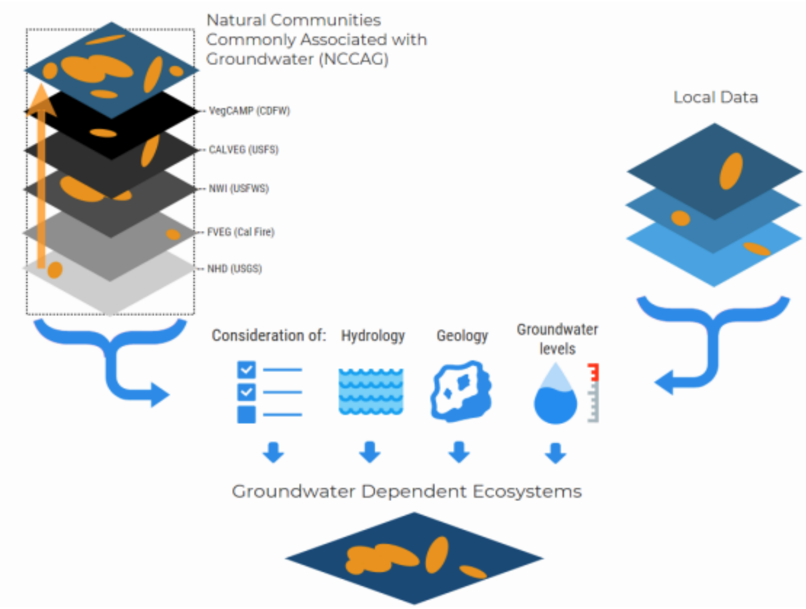


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

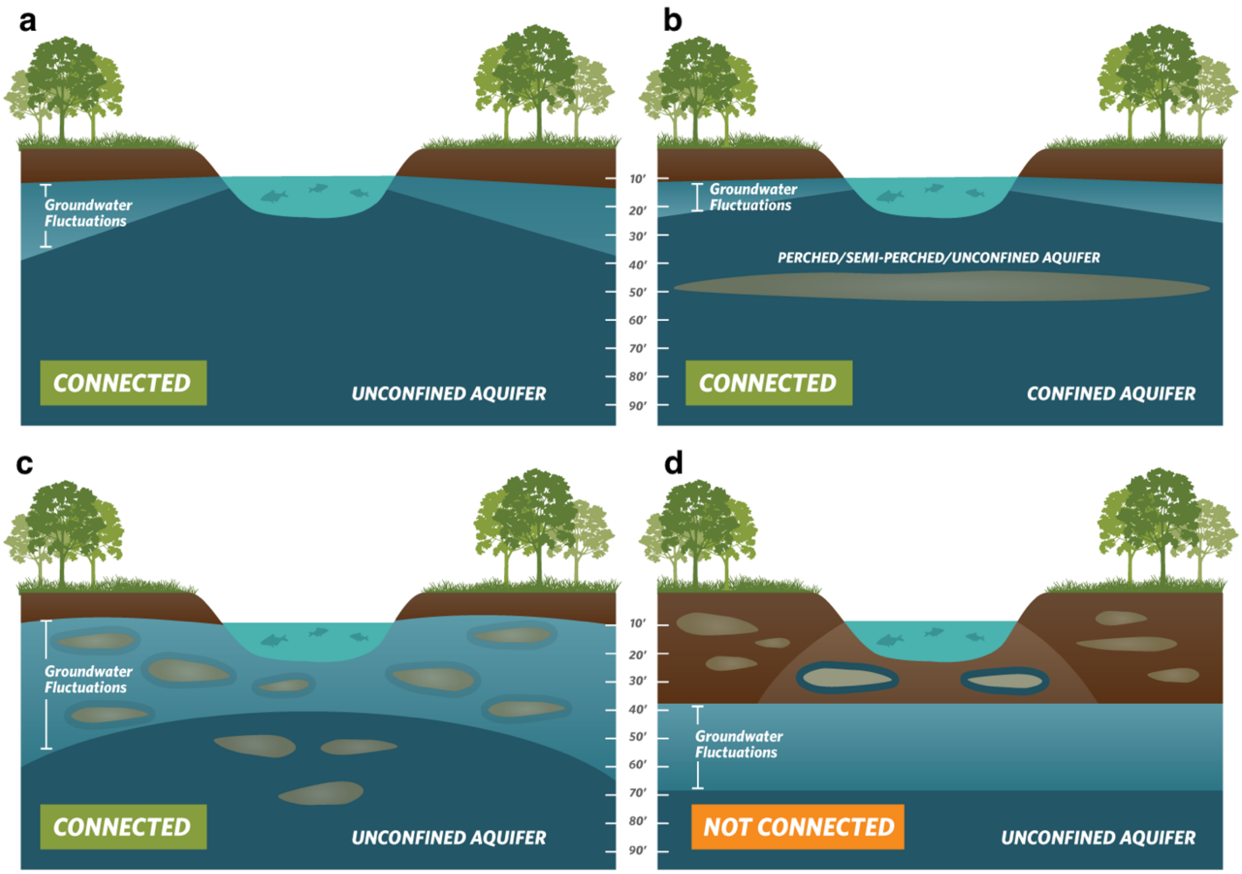


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

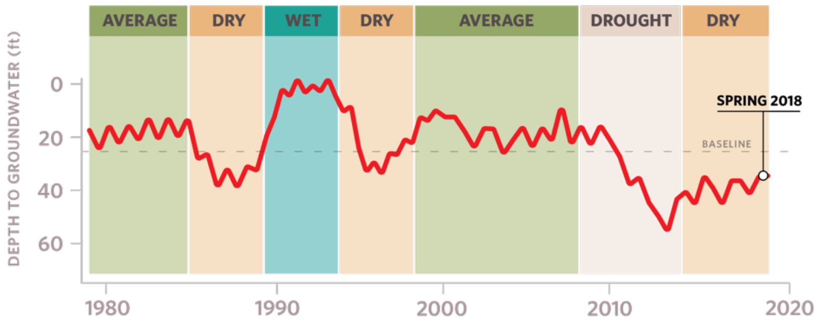


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

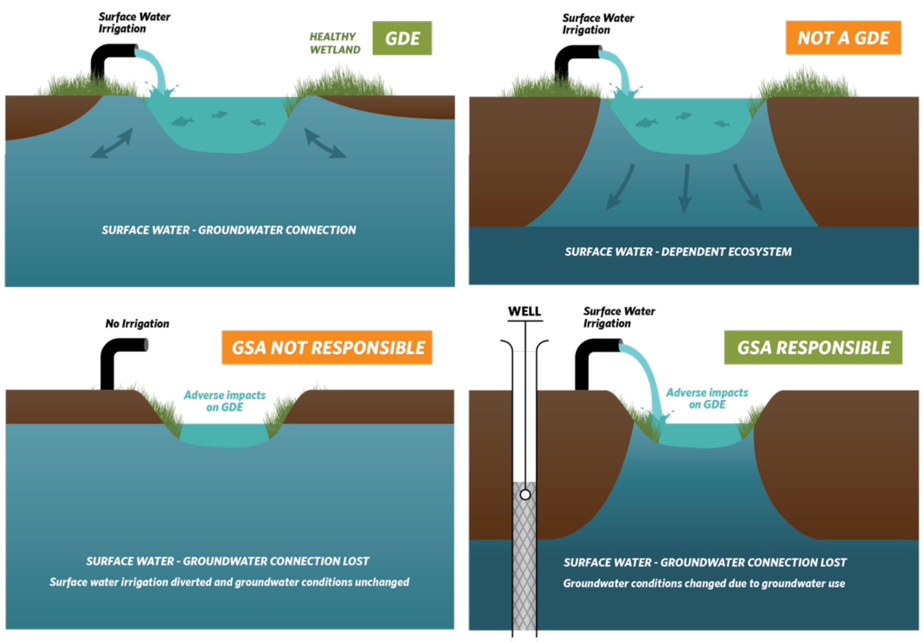

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

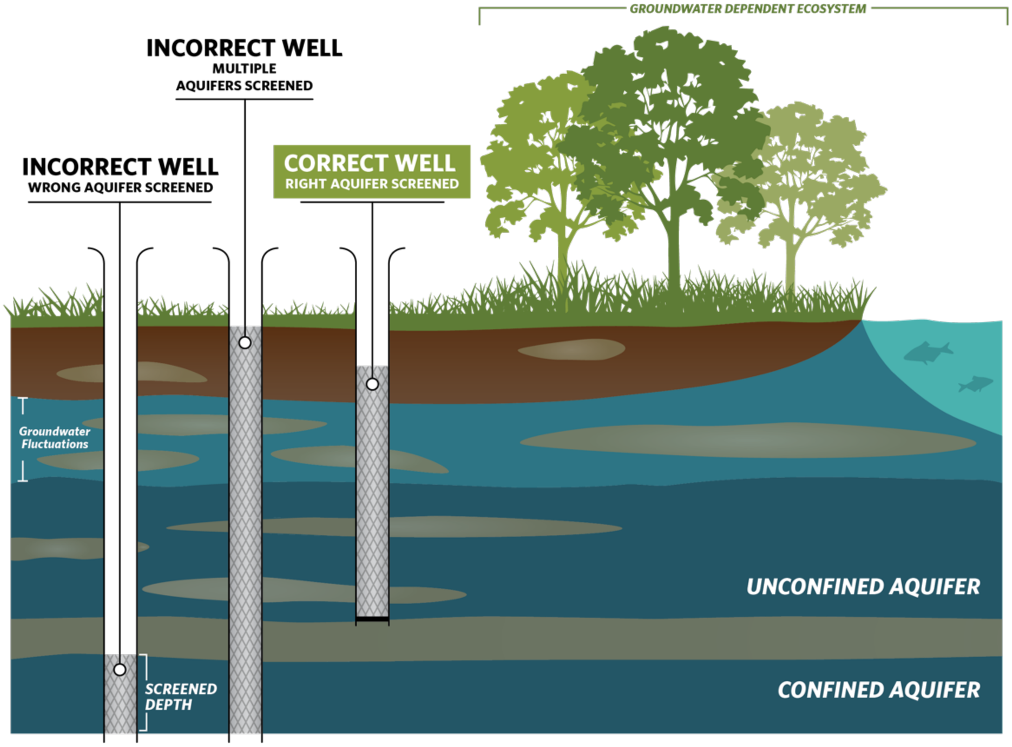

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

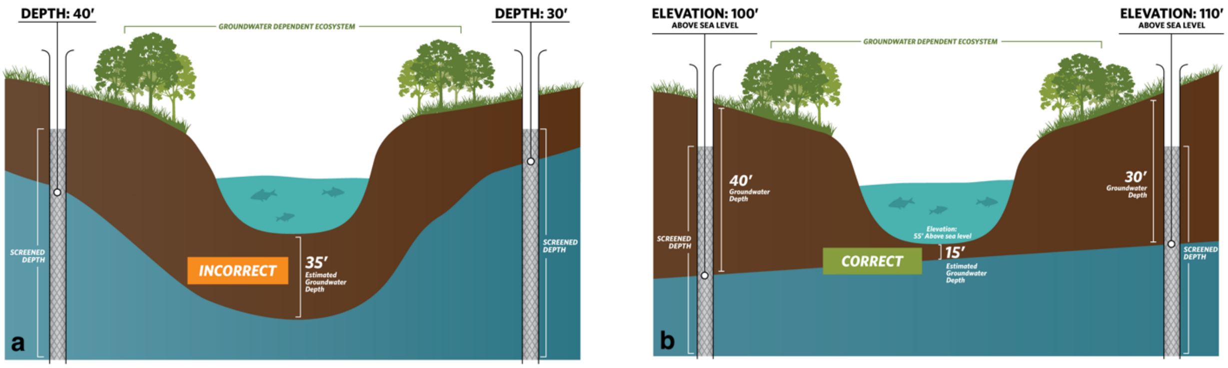

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

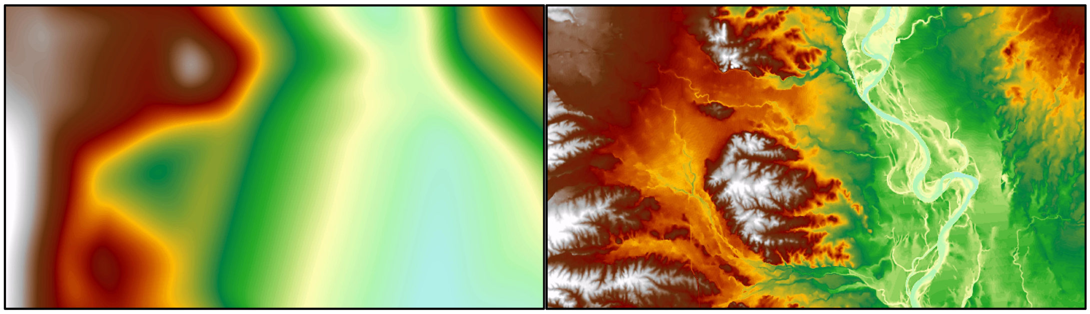

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

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[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

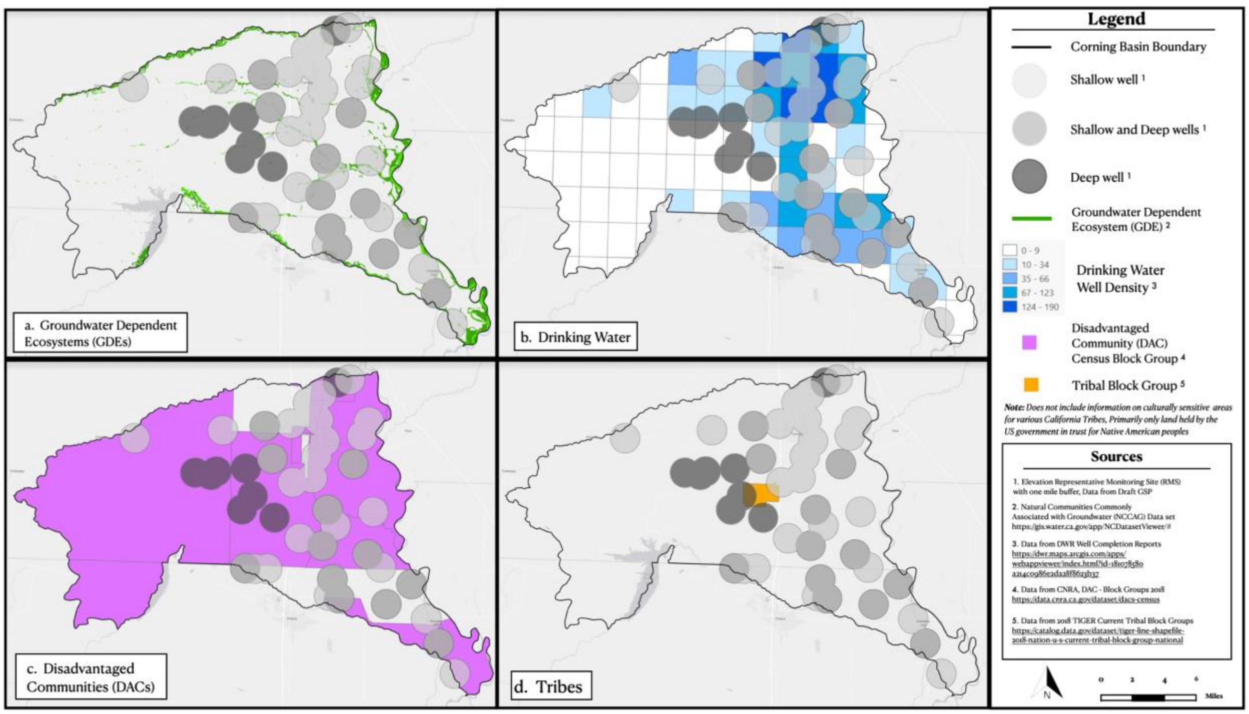

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

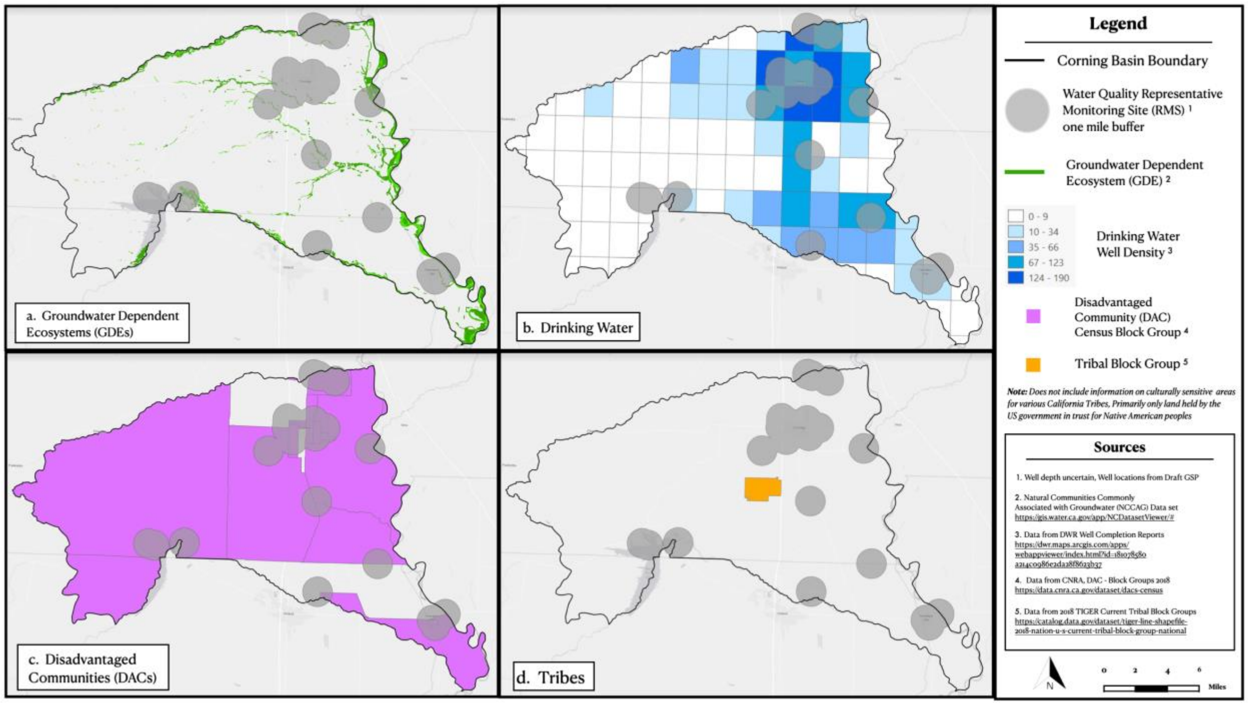

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

October 20, 2021

Cosumnes Subbasin SGMA Working Group
8970 Elk Grove Blvd.
Elk Grove, CA 95624

Submitted via web: https://www.surveymonkey.com/r/CosumnesGSP-Comment

Re: Public Comment Letter for Cosumnes Subbasin Draft GSP

Dear Stephen Julian,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Cosumnes Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Cosumnes Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Cosumnes Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP provides information on DACs, including identification by name and location on a map (Figure PA-10), and identifies the population of each identified DAC. The GSP sufficiently identifies and maps tribal lands within the subbasin in Section 5 of the GSP.

However, the GSP fails to include the population dependent on groundwater as their source of drinking water in the subbasin. While the plan provides a density map of domestic wells in the subbasin, the GSP fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). • Include a map showing average well depth across the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis and clear conclusions drawn about the presence of interconnected surface water.

The ISW section of the GSP presents a summary of the locations of groundwater wells used in the analysis and their screen depths, and describes the temporal (seasonal and interannual) variability of the data used. In Section 9.6.2, the GSP also presents conclusions drawn from use of the groundwater - surface water model, however no figure is presented which summarizes the conclusions about which reaches are interconnected or disconnected.

The GSP states (p. 124): “Data are not available to directly compare stage and groundwater levels along Dry Creek or other surface water features in the Basin. However, the depth to groundwater (DTW) contours mapped for the Basin indicate that groundwater in the Principal Aquifer is typically encountered at depths substantially greater than 30 ft bgs, suggesting that surface water flows and groundwater are likely disconnected across most of the Basin (Figure GWC-4 [Calculated Depth to Groundwater Fall 2018]).” Using depth to groundwater contours from one point in time is not sufficient evidence to state that reaches are not connected to groundwater. In California’s Mediterranean climate, groundwater interconnections with surface water can vary seasonally and interannually.

RECOMMENDATIONS

- Correlate explanation in the GSP text to a map of stream reaches in the subbasin, with reaches clearly labeled as interconnected or disconnected. On the stream reach map, include reaches with data gaps as potential ISWs.

- Further describe the groundwater elevation data and stream flow data used in the ISW analysis. Ensure depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) are used to determine the range of depth and capture the variability in environmental conditions inherent in California’s climate. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.

- Overlay the subbasin’s stream reaches on depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis.

- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources. The GSP states (p. 125): “Detailed investigation of the NCCAG data set included a desktop evaluation to identify potentially missing GDEs, followed by on- and off-site (remote) study of select sites for vegetation type, health, species composition, ecosystem change, geomorphic setting, inferred source aquifer, and man-made modifier (Appendix L).” However, we found that mapped features in the NC dataset were improperly disregarded, as described below:

- NC dataset polygons were incorrectly removed based on the assumption that they are supported by the shallow, perched water table. However, shallow aquifers that have the potential to support well development, support ecosystems, or provide baseflow to streams are principal aquifers, even if the majority of the subbasin’s pumping is occurring in deeper principal aquifers. If there are no data to characterize groundwater conditions in the shallow principal aquifer, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP.

- NC dataset polygons were incorrectly removed based on the presence or proximity of surface water. However, partial reliance on surface water does not necessarily prove that the plants and animals do not access groundwater. Many GDEs often simultaneously rely on multiple sources of water (i.e., both groundwater and surface water), or shift their reliance on different sources on an interannual or inter-seasonal basis.

The GSP states (Appendix L, p. 19): "*Depth to groundwater conditions within the Cosumnes Subbasin are shown in Figure 7 based on October 2018 groundwater measurements and groundwater elevation mapping from EKI (2019).*" We recommend using groundwater data from multiple seasons and water year types to determine the range of depth to groundwater around NC dataset polygons.

Footnote (3) on Table GWC-6 (Maximum Plant Rooting Depths for Potential GDEs) states (p. 127): *"There is a significant presence of Blue Oak in the Basin, largely in the drier (non-riparian/wetland) portions of the Basin Foothills Subarea, and it coexists with Live Oak. References to the potentially deep (80 ft bgs) rooting depths for Blue Oak pertain to trees growing in shallow soils (Lewis and Burgy, 1964). However, the Principal Aquifer is comprised of unconsolidated sediment – not fractured rock. Moreover, Blue Oak has low soil moisture requirements, and is not groundwater dependent or associated with wetland/riparian habitats. The 30 ft bgs is therefore utilized as the lower depth to water for GDEs."* The footnote refers to an entry in the table for valley oak (*Quercus lobata*), yet discusses blue oak and live oak. Clarify this footnote and see our recommendation below for using TNC's plant rooting depth database.

We commend the GSA for including an inventory of flora and fauna species and habitat types in the subbasin's GDEs. Table GWC-4 presents the vegetation and rooting depth found in potential GDEs. Appendix K contains TNC's freshwater species list for the Cosumnes subbasin, including fauna. Federal and state-listed endangered species present in the subbasin are discussed in the GDE section (Section 9.7) of the GSP.

RECOMMENDATIONS

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a pre-SGMA baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as valley oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

Native Vegetation and Managed Wetlands
Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included into the water budget. The integration of these ecosystems into the water budget is **insufficient**. The water budget did explicitly include the current, historical, and projected demands of native vegetation, but did not include the current, historical, and projected demands of managed wetlands. Managed wetlands are not mentioned in the GSP, but are present in DWR's statewide cropping dataset. The omission of explicit water demands for managed wetlands is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

RECOMMENDATION
• Discuss and map the presence of managed wetlands in the subbasin. Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including managed wetlands.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development
Stakeholder engagement during GSP development is **incomplete**. SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the Public Communication & Engagement Plan (Appendix D).

The GSA's outreach activities include inviting DAC contacts to subscribe to the Interested Parties list and attend meetings, press releases and/or news articles to advertise public workshops, stakeholder surveys for all landowners in the subbasin, posting bilingual SGMA documents to the website and making the website available in multiple languages, public webinars posted to YouTube, mailing notices to all landowners about workshops, and convening a Citizens Advisory Committee to inform GSP implementation.

We also note the GSA's specific outreach activities with tribal and environmental stakeholders, including a Tribal Outreach Committee, preparing background materials related to Native American tribal outreach and engagement, contacting tribal primary points of contact regarding formal communication for the SGMA and tribal interests, expanding monitoring networks, entering project partnerships with environmental stakeholders, promoting information tools and sharing, and sharing updates with the Surface Water Advisory Group. However, we note the following deficiency with the overall stakeholder engagement process. While outreach is well described for DACs, tribes, and environmental organizations during GSP development, there are no detailed outreach methods described for the GSP *implementation* process.

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[1] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]
[2] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]
[3] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

RECOMMENDATION
● In the Public Communication & Engagement Plan, describe active and targeted outreach to engage DAC members and environmental stakeholders throughout the GSP *implementation* phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[4] and establishing minimum thresholds.[5,6]

Disadvantaged Communities and Drinking Water Users
For chronic lowering of groundwater levels, the GSP discusses minimum thresholds impact on domestic wells (see Section 15.1.2 Domestic Well Impact Analysis). The GSP states (p. 186): "Hence, the GSAs have determined that significant and unreasonable effects will occur if the number of completely dewatered domestic wells exceeds the assumed natural well replacement rate projected to occur over the 20-year GSP implementation horizon (i.e., 26% of existing domestic wells in the Basin are at least 40 years old and would likely have to be replaced or rehabilitated due to age). Therefore, it cannot be considered "significant and unreasonable" if fewer wells in the Basin were impacted due to chronic lowering of groundwater levels in the Principal Aquifer than the assumed natural well replacement rate (26%)." The GSP further states: "The domestic well impact analysis suggests that if water levels across the entire Basin reached the proposed MTs, approximately 83 domestic wells (3.5%) could be partially dewatered and 48 domestic wells (2.0%) could be completely dewatered. This condition represents a net increase above 2015 from 65 to 83 partially dewatered wells (a net increase of 18 wells), and 36 to 48 fully dewatered wells (a net increase of 12 wells). These limited projected incremental impacts are not considered to be 'significant and unreasonable' since the number of completely and/or partially dewatered domestic wells is far below the 26% of wells that are likely to require replacement based on well age and lifespan alone."

The GSP does not however, sufficiently describe or analyze direct or indirect impacts on DACs or tribes when defining undesirable results, nor does it describe how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results to DACs and tribes in the subbasin. Furthermore, there is no explanation of the correlation between "natural well replacement" and those that will be dewatered (e.g., it is possible all dewatered wells could be far from their replacement date).

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[4] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
[5] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[6] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

For degraded water quality, the GSP states that arsenic, nitrate, and TDS have been identified as constituents of concern (COCs) in the subbasin. The minimum thresholds for degraded water quality are set for arsenic and nitrate at their respective primary maximum contaminant levels (MCLs) and the minimum threshold for TDS is set to the secondary upper limit MCL. The GSP states (p. 207): "Certain other constituents with Secondary MCLs (including chloride, sulfate, iron and magnesium) have been measured in wells in the Basin at concentrations exceeding their respective Secondary MCLs. Since these constituents do not pose risks to human health, and because monitoring TDS serves as an indicator of general drinking water quality, SMCs were not developed for these other constituents." However, SMC should be established for all COCs in the subbasin that may be impacted and/or exacerbated by groundwater use or management. Naturally occurring COCs can be exacerbated as a result of groundwater use or groundwater management within the subbasin.

The GSP only includes a very general discussion of impacts to drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs or tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs or tribes.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels (in addition to describing impacts to drinking water users).

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[7]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin, including naturally occurring constituents that can be exacerbated as a result of groundwater use or groundwater management. Ensure they align with drinking water standards[8].

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP only considers GDEs with respect to the depletion of interconnected surface water sustainability indicator, but not the chronic lowering of groundwater levels sustainability indicator. No analysis or discussion is provided in the GSP that describes impacts to GDEs or establishes SMC for GDEs that are directly dependent on groundwater. This is problematic because without

[7] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[8] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

identifying potential impacts to GDEs, minimum thresholds may compromise these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC for chronic lowering of groundwater levels.

For depletion of interconnected surface water, the GSP established minimum thresholds and measurable objectives in GDE areas (Table SMC-7). However, no analysis or discussion is presented to describe how the SMC will affect GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when ‘significant and unreasonable’ effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[9] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[10] can be determined.

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs should include “impacts on groundwater dependent ecosystems”.

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached[11]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,12].

[9] “The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results”. [23 CCR §354.26(b)(3)]
[10] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.” [23 CCR §354.28(b)(4)]
[11] “The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results.” [23 CCR §354.28(c)(6)]
[12] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California’s threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[13] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **incomplete**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070, and also considers multiple climate scenarios (e.g., the 2070 drier with extreme warming and wetter with moderate warming) in the projected water budget.

The GSP also includes climate change into key inputs (e.g., precipitation, evapotranspiration, and surface water flow) of the projected water budget and calculates a sustainable yield based on the projected water budget with climate change incorporated. However, imported water, while accounted for in historical and current water budgets, is not included in the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of climate-adjusted imported water inputs, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Incorporate climate change into imported water inputs for the projected water budget.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Wells (RMWs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, and tribes in the subbasin.

Figure MN-1 (SGMA Monitoring Network for Chronic Lowering of Groundwater Levels) and Figure MN-2 (SGMA Monitoring Network for Degraded Water Quality) show that no monitoring wells are located across portions of the subbasin near DACs, domestic wells, and tribes (see maps provided in Attachment E). Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[14].

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[13] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[14] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

The GSP provides discussion and plans to fill data gaps for GDEs and ISWs in Sections 17.1.6 (Monitoring Network for Depletions of Interconnected Surface Water) and Section 19.1.2 (Data Gap Filling Efforts).

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and tribes to clearly identify potentially impacted areas. Increase the number of RMWs in the shallow aquifer across the subbasin as needed to adequately monitor all groundwater condition indicators. Prioritize proximity to DACs, drinking water users, and tribes when identifying new RMWs.

- Describe the biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin. The GSP states that GDE monitoring and assessments are further discussed in Section 19.1.6, but this discussion is not provided.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

The GSP recognized that up to 83 domestic wells (3.5% of domestic wells in the subbasin) could be impacted at minimum thresholds, and argues that because this percentage is less than the assumed natural well replacement rate of 26%, this impact cannot be considered significant and unreasonable. However, the GSA does not provide a comprehensive definition of what they mean by well rehabilitation, nor does the GSA recognize that drilling a deeper well entails additional cost than is required to replace a well at the same depth. To an individual well owner whose well has been impacted (e.g., requires rehabilitation, requires a deeper well, or experiences dewatering for a portion of the year), these impacts should be considered ‘significant and unreasonable. For this reason, we strongly recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the “Multi-Benefit Recharge Project Methodology Guidance Document”[15].

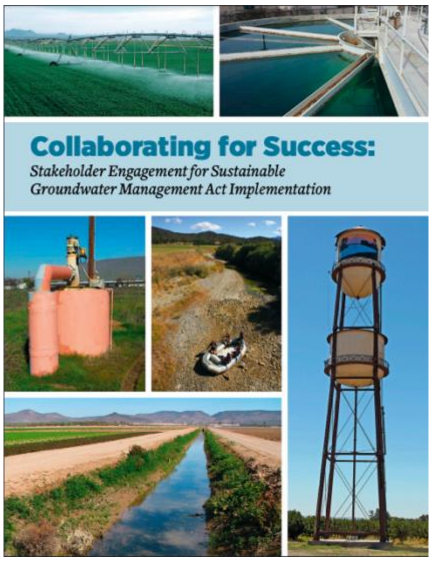
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[15] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

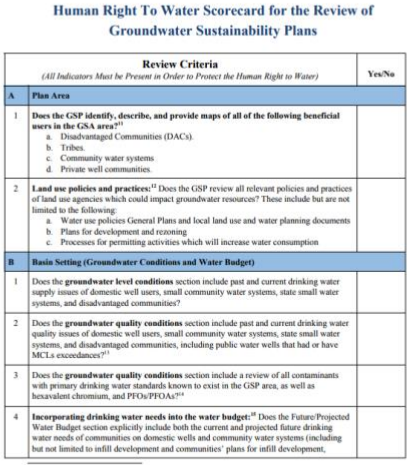
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

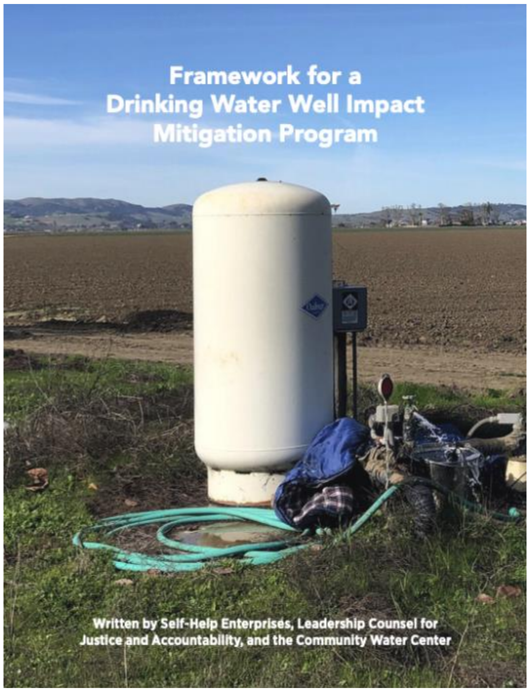


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*		Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

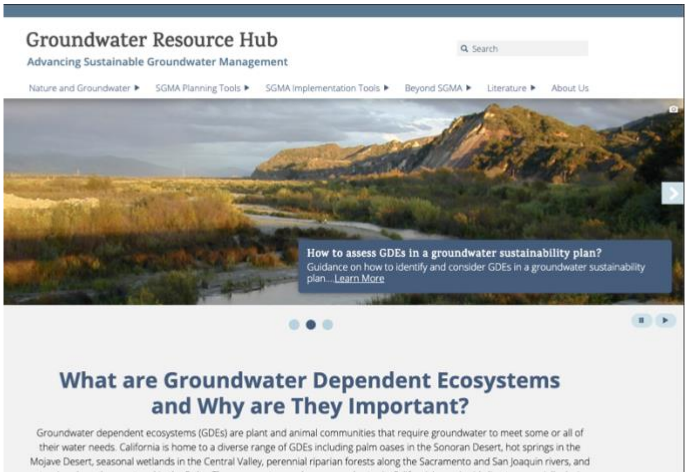
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



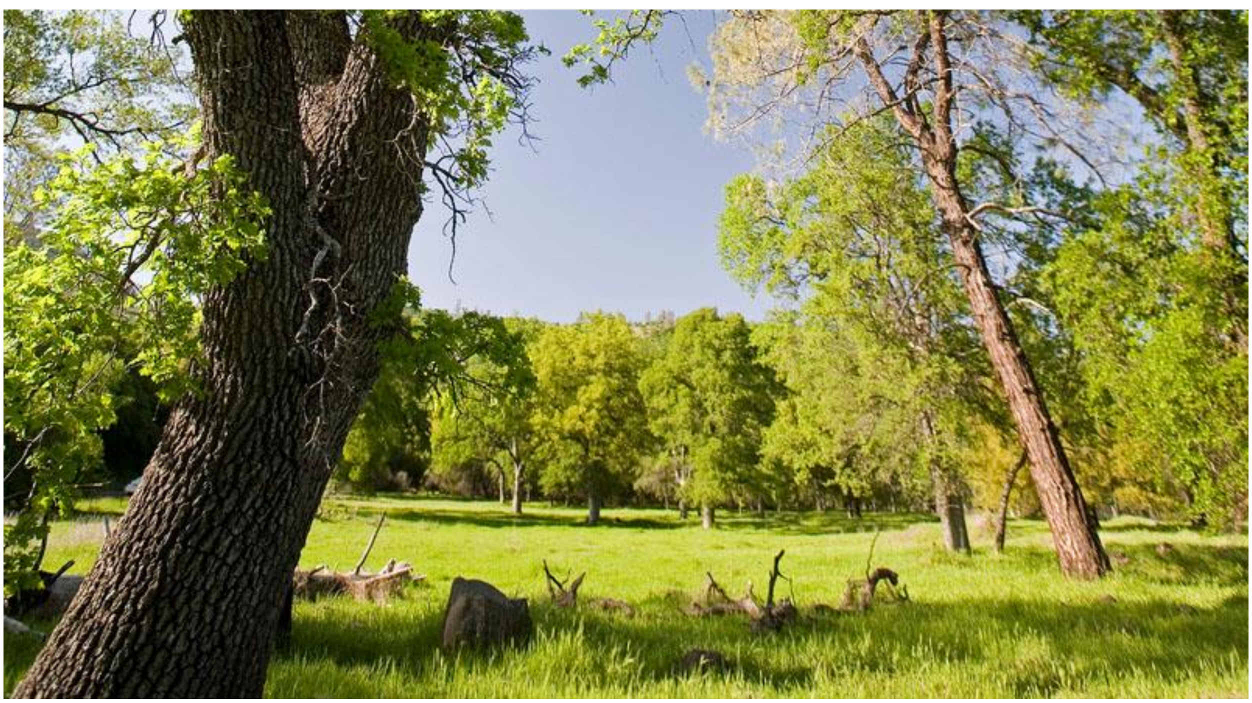
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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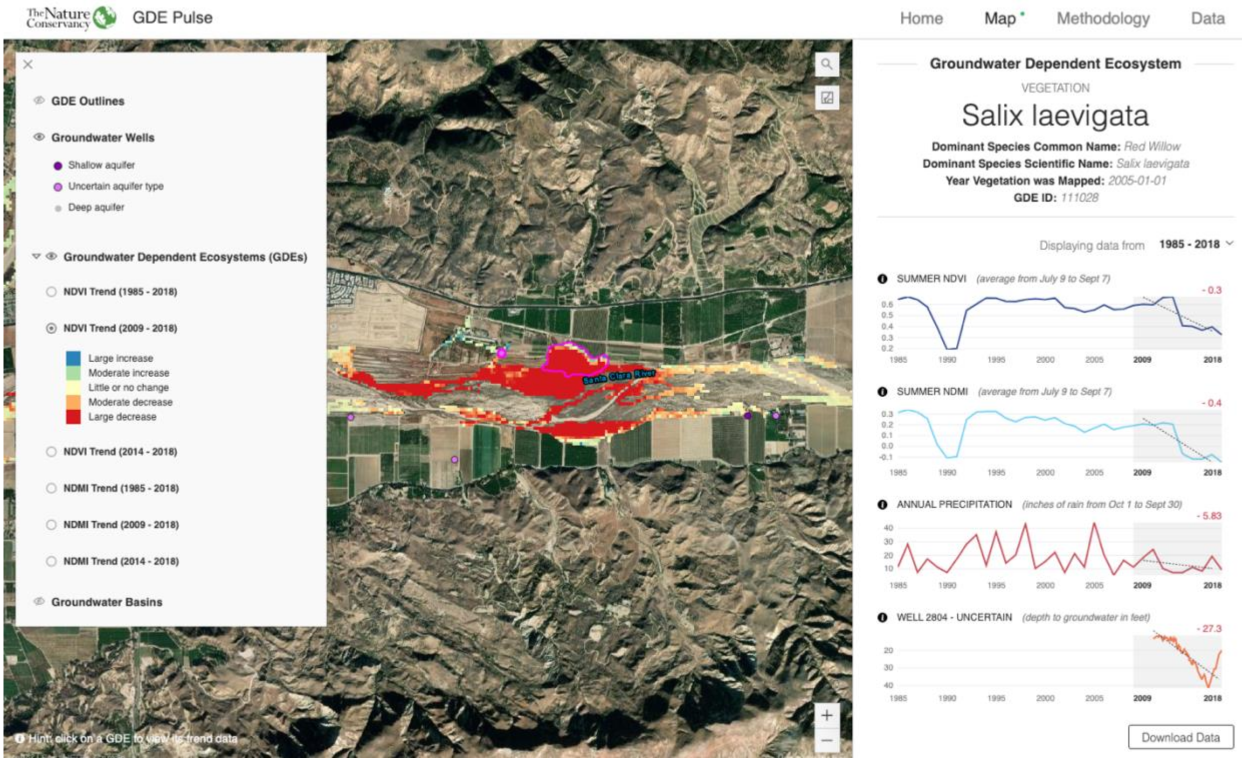
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

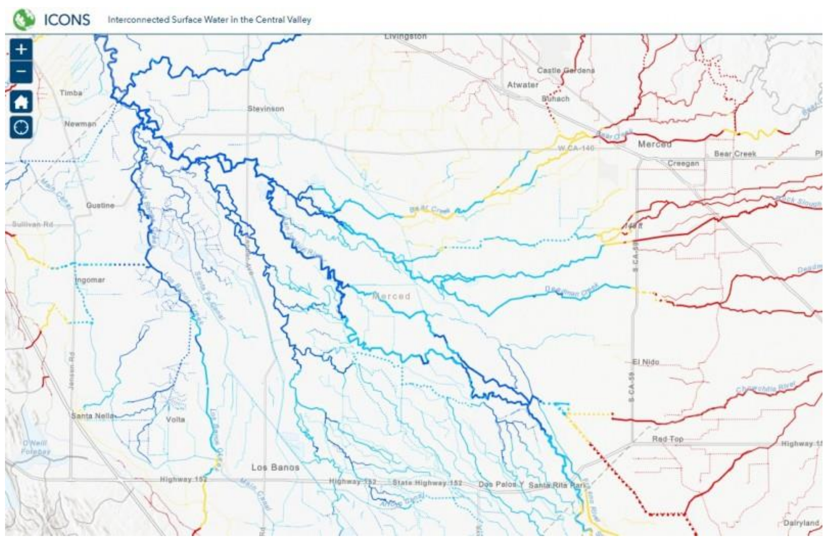
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Cosumnes Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result “depletion of interconnected surface waters”, Attachment C provides a list of freshwater species located in the Cosumnes Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife’s BIOS[2] as well as on The Nature Conservancy’s science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			

Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
CRUSTACEANS				
Branchinecta mesovallensis	Midvalley Fairy Shrimp		Special	
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			

Pseudacris regilla	Northern Pacific Chorus Frog			
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Anax junius	Common Green Darner			
Enallagma civile	Familiar Bluet			
Erythemis collocata	Western Pondhawk			
Hetaerina americana	American Rubyspot			
Ischnura cervula	Pacific Forktail			
Libellula luctuosa	Widow Skimmer			
Libellula pulchella	Twelve-spotted Skimmer			
Pachydiplax longipennis	Blue Dasher			
Pantala hymenaea	Spot-winged Glider			
Progomphus borealis	Gray Sanddragon			
Rhionaeschna multicolor	Blue-eyed Darner			
Sympetrum corruptum	Variegated Meadowhawk			
Tramea lacerata	Black Saddlebags			
Paraleptophlebia placeri	A Mayfly			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Margaritifera falcata	Western Pearlshell		Special	
Castilleja campestris succulenta	Fleshy Owl's-clover	Threatened	Endangered	CRPR - 1B.2
PLANTS				
Downingia pusilla	Dwarf Downingia		Special	CRPR - 2B.2
Eryngium pinnatisectum	Tuolumne Coyote-thistle		Special	CRPR - 1B.2
Legenere limosa	False Venus'-looking-glass		Special	CRPR - 1B.1
Navarretia myersii myersii	Pincushion Navarretia		Special	CRPR - 1B.1
Orcuttia viscida	Sacramento Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Sagittaria sanfordii	Sanford's Arrowhead		Special	CRPR - 1B.2
Alnus rhombifolia	White Alder			

Alopecurus carolinianus	Tufted Foxtail			
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Ammannia robusta	Grand Redstem			
Arundo donax	NA			
Azolla filiculoides	NA			
Bacopa rotundifolia	NA			
Beckmannia syzigachne	American Sloughgrass			
Brodiaea nana				Not on any status lists
Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche heterophylla heterophylla	Northern Water-starwort			
Callitriche marginata	Winged Water-starwort			
Carex densa	Dense Sedge			
Carex feta	Green-sheath Sedge			
Carex neurophora	Alpine-nerved Sedge			
Cephalanthus occidentalis	Common Buttonbush			
Cicendia quadrangularis	Oregon Microcala			
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Crypsis vaginiflora	NA			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus fuscus	NA			
Cyperus involucratus	NA			
Damasonium californicum				Not on any status lists
Downingia bicornuta	NA			
Downingia cuspidata	Toothed Calicoflower			
Downingia ornatissima	NA			
Downingia pulchella	Flat-face Downingia			
Echinochloa oryzoides	NA			
Echinodorus berteroi	Upright Burhead			
Elatine brachysperma	Shortseed Waterwort			
Elatine californica	California Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			

Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eragrostis hypnoides	Teal Lovegrass			
Eryngium aristulatum aristulatum	California Eryngo			
Eryngium articulatum	Jointed Coyote-thistle			
Eryngium castrense	Great Valley Eryngo			
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Glyceria borealis	Small Floating Mannagrass			
Gratiola ebracteata	Bractless Hedge-hyssop			
Gratiola neglecta	Clammy Hedge-hyssop			
Helenium puberulum	Rosilla			
Isoetes howellii	NA			
Isoetes nuttallii	NA			
Isoetes orcuttii	NA			
Juncus acuminatus	Sharp-fruit Rush			
Juncus articulatus articulatus				Not on any status lists
Juncus effusus effusus	NA			
Juncus phaeocephalus paniculatus	Brownhead Rush			
Juncus phaeocephalus phaeocephalus	Brown-head Rush			
Juncus uncialis	Inch-high Rush			
Juncus xiphioides	Iris-leaf Rush			
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Limnanthes alba alba	White Meadowfoam			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limnanthes douglasii rosea	Douglas' Meadowfoam			
Limnanthes douglasii striata				Not on any status lists
Limosella acaulis	Southern Mudwort			
Ludwigia grandiflora	NA			
Ludwigia hexapetala	NA			Not on any status lists
Ludwigia peploides montevidensis	NA			Not on any status lists

Ludwigia peploides peploides	NA			Not on any status lists
Lycopus americanus	American Bugleweed			
Lythrum californicum	California Loosestrife			
Lythrum portula	NA			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Mimulus tricolor	Tricolor Monkeyflower			
Montia fontana fontana	Fountain Miner's-lettuce			
Myosurus minimus	NA			
Myriophyllum aquaticum	NA			
Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Oenanthe sarmentosa	Water-parsley			
Panicum acuminatum acuminatum				Not on any status lists
Panicum dichotomiflorum	NA			
Paspalum distichum	Joint Paspalum			
Perideridia bolanderi involucrata	Bolander's Yampah			
Persicaria hydropiperoides				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys austiniae	Austin's Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plagiobothrys undulatus	NA			Not on any status lists
Plantago elongata elongata	Slender Plantain			

Pleuropogon californicus californicus				Not on any status lists
Pogogyne douglasii	NA			
Pogogyne zizyphoroides				Not on any status lists
Potamogeton diversifolius	Water-thread Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus brevissimus multiflorus	Delta Woolly Marbles		Special	CRPR - 4.2
Psilocarphus oregonus	Oregon Woolly-heads			
Psilocarphus tenellus	NA			
Ranunculus alismifolius alismifolius	Water-plantain Buttercup			
Ranunculus aquatilis aquatilis	White Water Buttercup			
Ranunculus pusillus pusillus	Pursh's Buttercup			
Ranunculus sceleratus	NA			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rotala ramosior	Toothcup			
Rumex conglomeratus	NA			
Rumex salicifolius salicifolius	Willow Dock			
Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Sagittaria montevidensis calycina				Not on any status lists
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Samolus parviflorus	NA			Not on any status lists
Sidalcea calycosa calycosa	Annual Checker-mallow			
Sidalcea hirsuta	Hairy Checker-mallow			
Stachys ajugoides	Bugle Hedge-nettle			
Stachys albens	White-stem Hedge-nettle			
Stachys stricta	Sonoma Hedge-nettle			

Toxicoscordion venenosum venenosum				Not on any status lists
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	NA			
Veronica catenata	NA			Not on any status lists
Veronica peregrina	NA			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

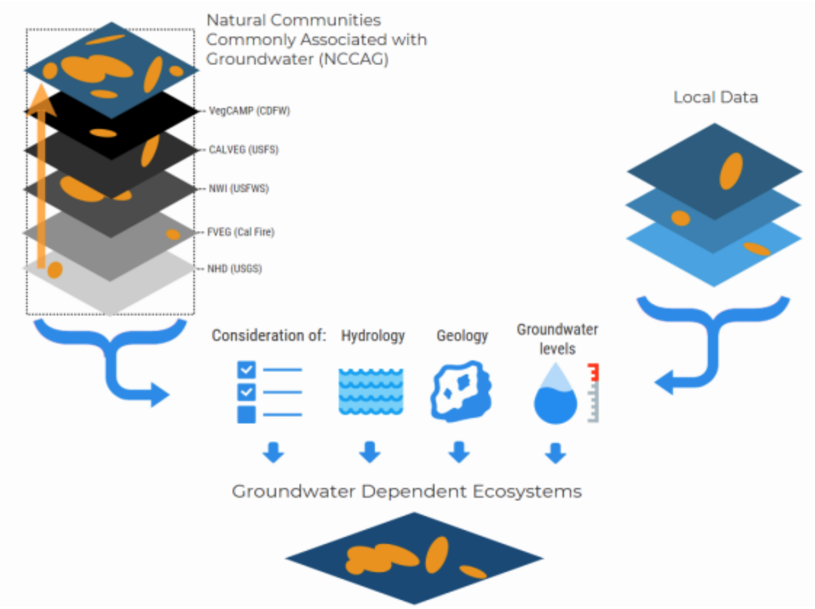


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

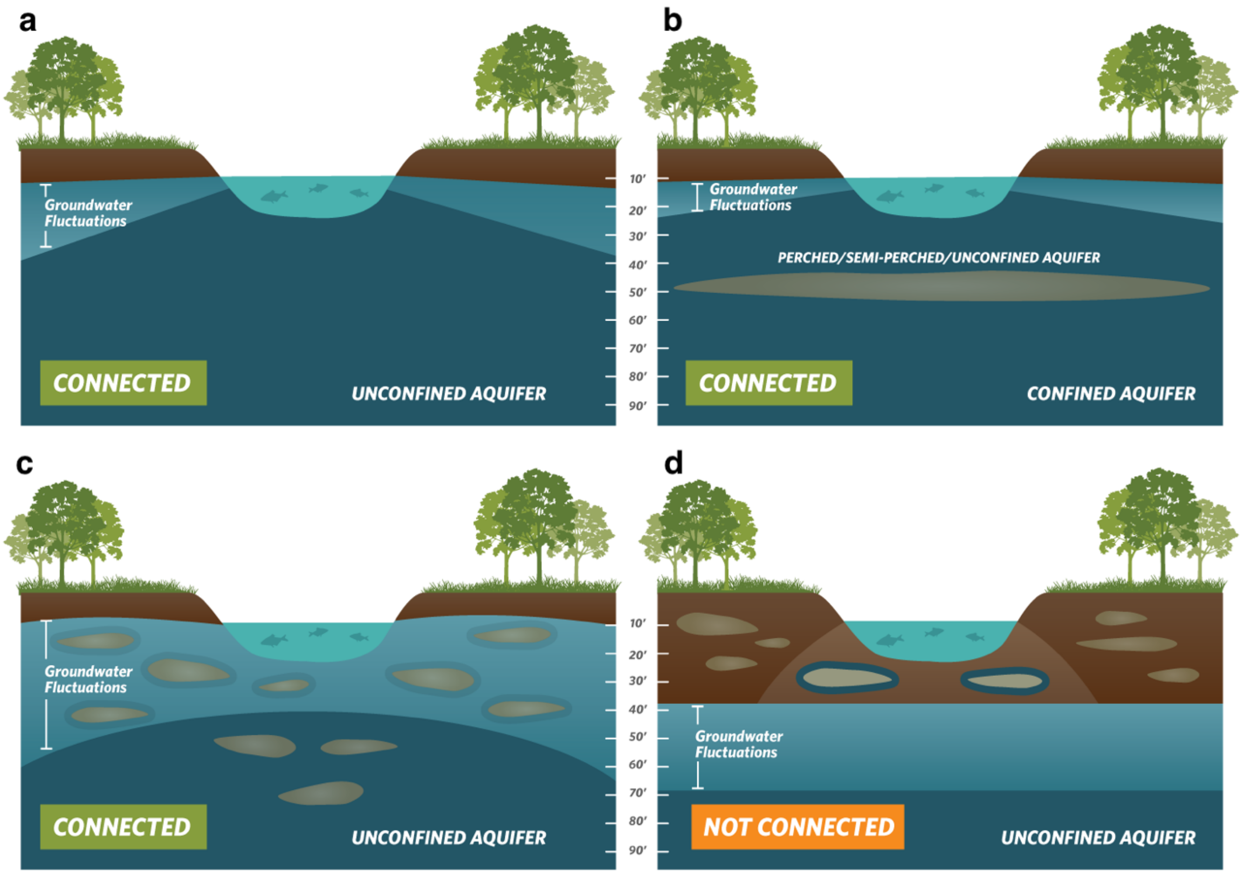


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

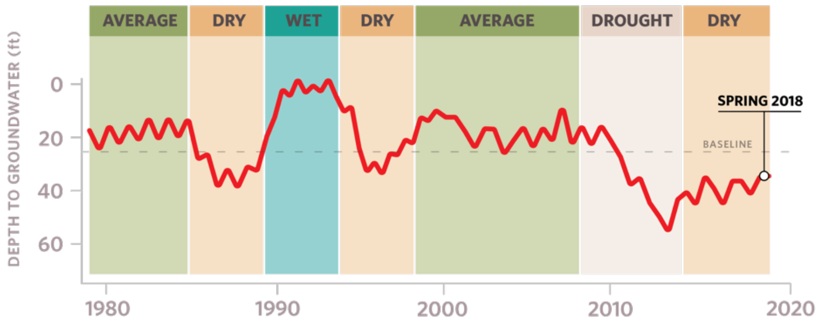


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

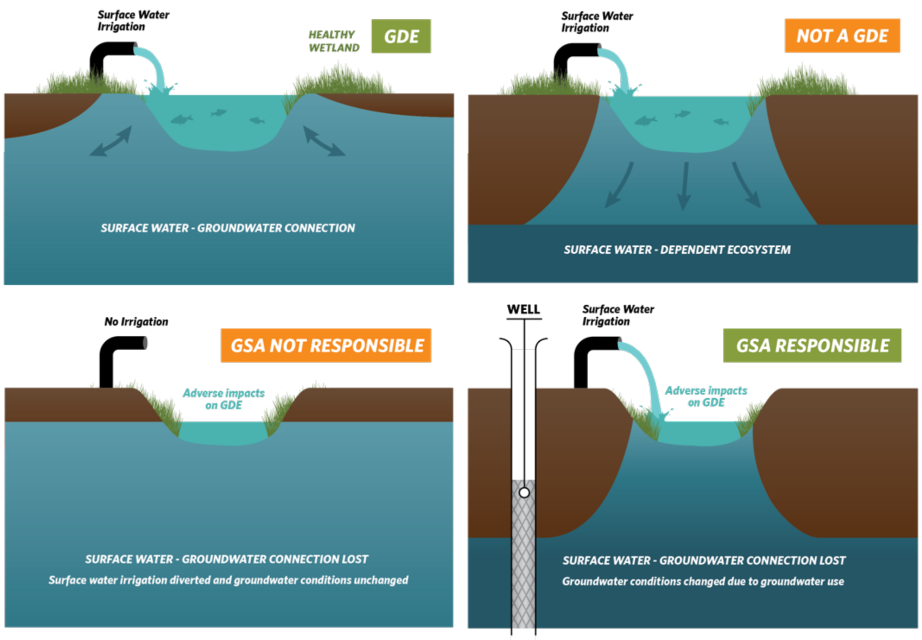

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

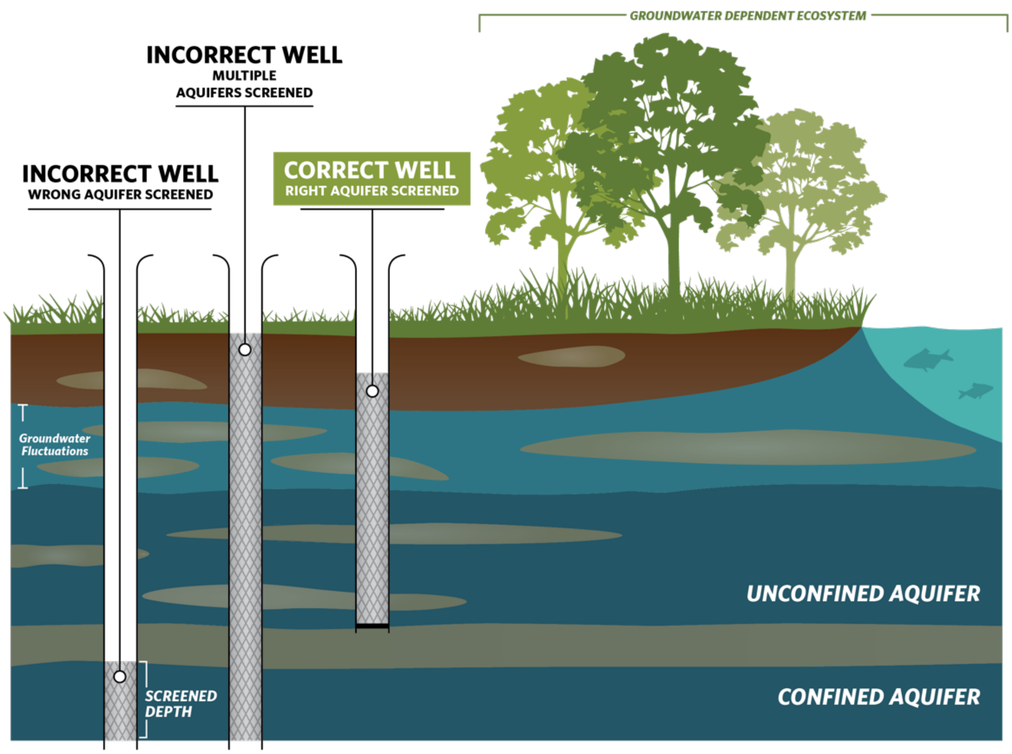

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

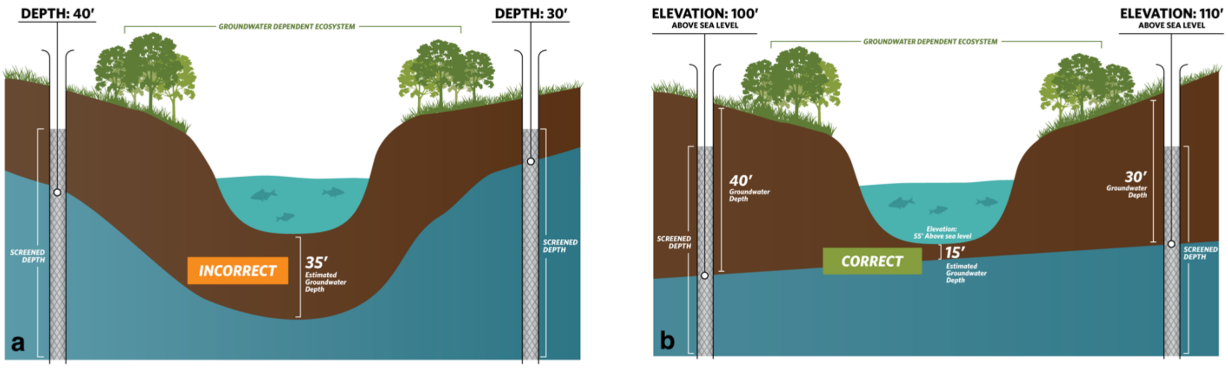

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

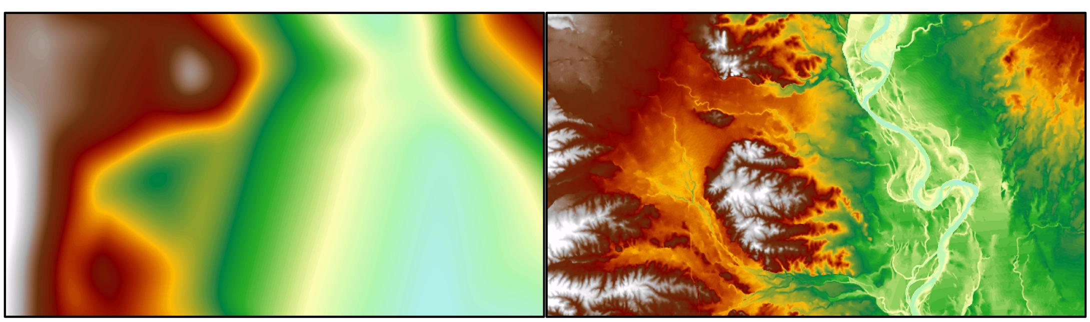

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

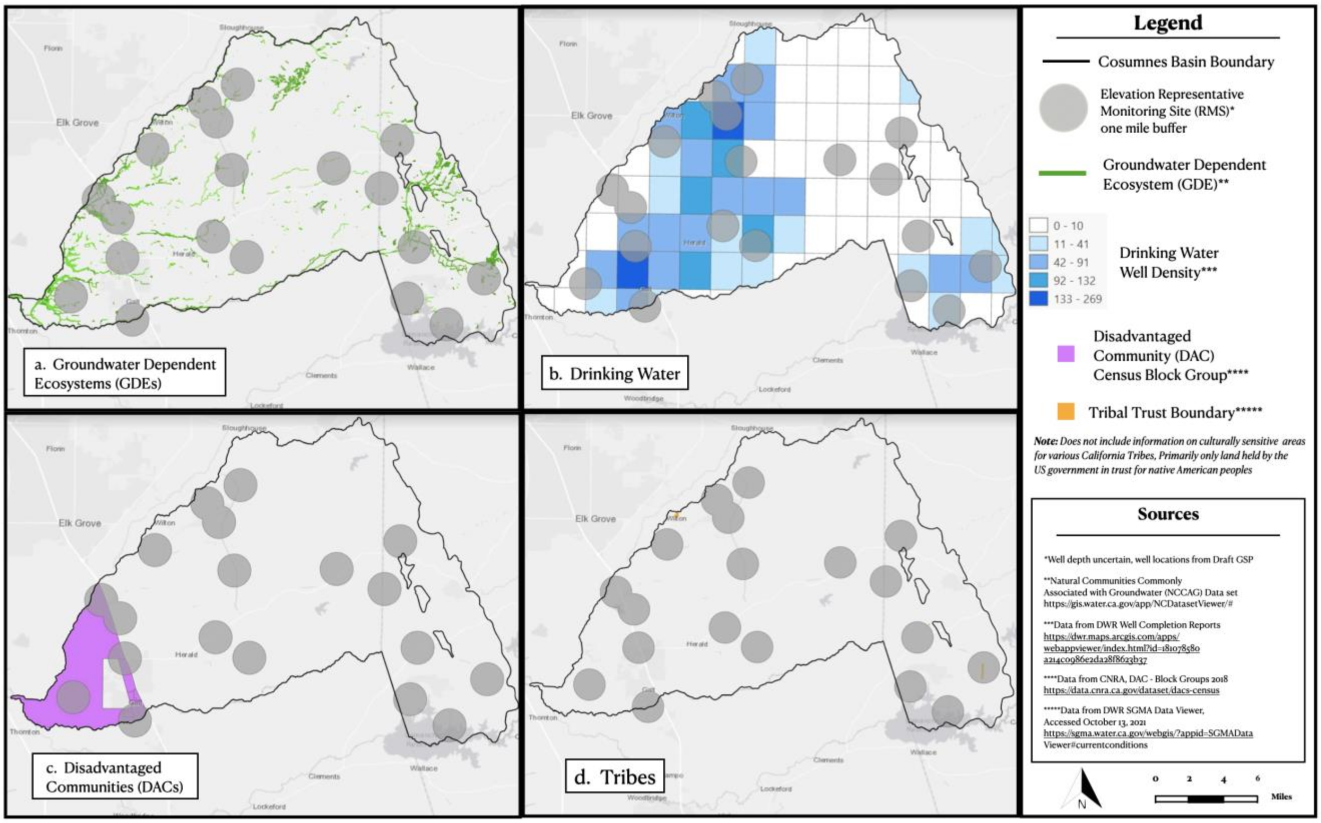

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

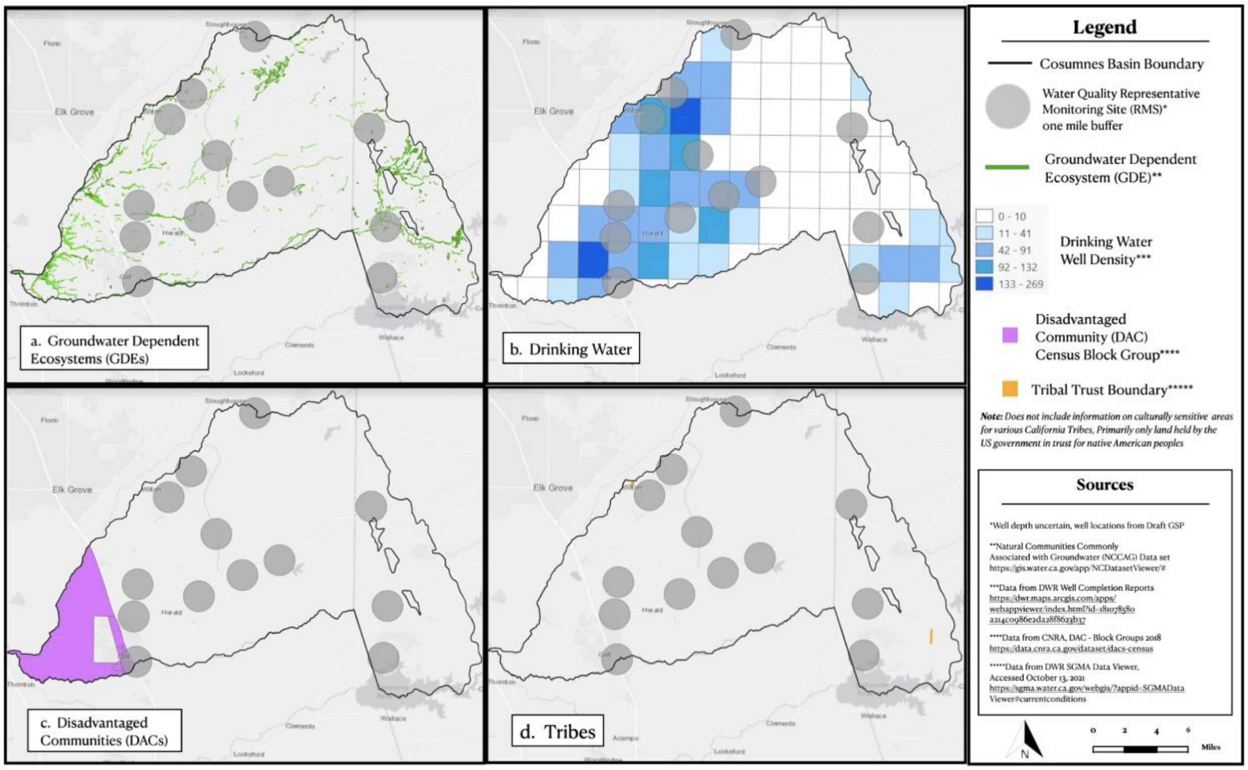

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

November 1, 2021

East Bay Municipal Utility District
375 11th Street
Oakland, CA 94607

Submitted via email: amy@ebmud.com

Re: Public Comment Letter for East Bay Plain Subbasin Draft GSP

Dear Amy Underwood,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the East Bay Plain Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the East Bay Plain Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the East Bay Plain Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP provides information on DACs, including identification by name and location on a map (Figure 1-1). However, the GSP fails to clearly state the population of each DAC.

The GSP provides a density map of domestic wells in the subbasin (Figure 2-2). However, the plan fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.

These missing elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide the population of each identified DAC. • Include a map showing domestic well locations and average well depth across the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **insufficient**, due to lack of supporting information provided for the ISW analysis.

Section 2.2.2.6 of the GSP describes surface water and groundwater Interaction. This section concludes with the following statement (p. 2-36): *"In general, depths to groundwater in the Upper Shallow Aquifer Zone are less than 20 ft bgs in most of the EBP Subbasin, although there are*

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

some areas with groundwater levels between 20 ft and 30 ft bgs or more. Overall, depth to groundwater generally decreases from northeast (near the East Bay Hills) to southwest (San Francisco Bay) across the Subbasin, albeit with significant local variations. Thus, it can be expected that the potential for surface water/groundwater connection increases from east to west. In addition, where a surface water/groundwater connection is present, it can be expected that losing conditions are more likely in the eastern portion of the Subbasin and gaining conditions have more potential to occur in the western portion of the Subbasin. It should also be noted that portions of creek lengths are lined within the EBP Subbasin; particularly, for San Lorenzo Creek where a majority of the creek bed is lined until about one mile inland from the Bay Margin."

Appendix H of Appendix 2.A.b provides a review of prior surface water - groundwater interaction studies. It concludes with the following statement: *"Taken together, the studies document flashy stream behavior, with a major component of streamflow generation from groundwater, even during runoff events."* The two sections of the GSP described herein imply that most or all of the subbasin's surface water reaches are interconnected. However, no figure of stream reaches in the subbasin is provided that presents the conclusions of the ISW analysis.

Section 2.2.2.6 of the GSP (Surface Water/Groundwater Interaction) refers to Figure 2-37 (Map of Depth to Water Table – Spring 2015). These are the only data discussed when referring to depth to water. Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs. The use of data from one point in time does not reflect the temporal (seasonal and interannual) variability inherent in California's climate.

RECOMMENDATIONS

- Provide a map showing all the stream reaches in the subbasin, with reaches clearly labeled as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.
- Provide depth-to-groundwater contour maps using the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.
- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset), referred to as the iGDE dataset in the GSP. However, we found that some mapped features in the NC dataset were improperly disregarded. NC dataset polygons were incorrectly removed in areas adjacent to irrigated fields or due to the presence of surface water supplies. However, this removal criteria is flawed since GDEs can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields – simultaneously and at different temporal/spatial scales. NC dataset polygons adjacent to irrigated land or surface water supplies can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to irrigated fields or surface water supplies.

The GSP states that depth to groundwater from fall 2014 and spring 2015 (Figures 5-61 and 5-62) were used to assess the GDE polygons' connection to groundwater. The GSP states (p. 66 of Appendix 2.A.b): *"No GDEs were excluded based on depth to groundwater. Depth to groundwater, based on Fall 2014 data, was 30 ft or less across the East Bay Subbasin (although data are lacking for most areas along the eastern margin of EBP Subbasin where depth to water may be greatest)."* While we recognize that no NC dataset polygons were removed based on depth to groundwater, we recommend using groundwater data from multiple seasons and water year types to determine the range of depth to groundwater around NC dataset polygons and to more completely describe groundwater conditions within the subbasin's GDEs.

The GSP states (p. 65 of Appendix 2.A.b): *"After review of aerial imagery, a total of 38 acres of potential GDEs were excluded from the original iGDE database, 537 acres were flagged as needing additional data (e.g., field assessments), and 154 were verified as potential GDEs."* The GSP continues (p. 70 of Appendix 2.A.b): *"Field investigations for the 537 acres of features flagged as needing additional data are recommended in the future (after submittal of the GSP) to better assess vegetation communities and hydrologic inputs."* We recommend that the 537 acres flagged as needing additional data are also included as potential GDEs until the data gaps are filled.

RECOMMENDATIONS

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

Native Vegetation and Managed Wetlands
Native vegetation and managed wetlands are water use sectors that are required to be included into the water budget.[2,3] The integration of native vegetation into the water budget is **insufficient**. The water budget did not explicitly include the current, historical, and projected demands of native vegetation. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the subbasin.

RECOMMENDATIONS
• Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation. • State whether or not there are managed wetlands in the subbasin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development
Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Stakeholder Communication and Engagement Plan (Appendix 2.B.a).[4] We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms for listed stakeholders. They include attendance at GSA board and general stakeholder meetings, updates to the SGMA webpage, and access to GSA staff via email/telephone. There is no described outreach during the GSP development process that is specifically directed at DACs, domestic well owners, or environmental stakeholders.

- Aside from the continuation of engagement strategies used during the GSP development process, the Stakeholder Communication and Engagement Plan does not include a detailed plan for continual opportunities for engagement through the *implementation* phase of the GSP that is specifically directed to DACs, domestic well owners, and environmental stakeholders.

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[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]
[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]
[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

RECOMMENDATIONS

- In the Stakeholder Communication and Engagement Plan, describe active and targeted outreach to engage DAC members, domestic well owners, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the subbasin within the GSP.[5]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the minimum threshold for shallow aquifer zone groundwater levels is set at 50 feet below the ground surface. To explain the rationale, the GSP states (p. 3-15): *"California well standards require a minimum 50-foot well seal for community water system and municipal water supply wells. Domestic and industrial wells have a 20-foot minimum well seal requirement. With respect to development of drinking water supply wells in the urban EBP Subbasin (including domestic wells that may serve as drinking water supply wells), it is reasonable to assume that drinking water supply wells of any type would have a well seal that is at least 50-feet or greater in depth (preferably at least 100 feet deep) to protect the well from potential contaminants originating at ground surface (e.g., fuel hydrocarbons, solvents, nitrate) that are known to impact the upper 100 feet of sediments in the EBP Subbasin. Thus, a conservative assumption is that drinking water supply wells are a minimum of 60 feet deep to allow for a 50-foot well seal and some intake area; it is very likely that drinking water supply wells would need to be considerably deeper than 60 feet to obtain groundwater of suitable quality and to have some protection against the most likely potential contaminants. Based on the assessment of the DWR WCR database described above, the methodology for establishing MT for the shallow (water table) zone chronic lowering of groundwater levels is based in part on an assumed minimum well depth for drinking water supply wells of 60 feet."*

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[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

The GSP states that depth to water is generally less than 20 feet in the shallow aquifer zone. Furthermore, as stated in the quoted text above, domestic and industrial wells have a 20-foot minimum well seal requirement. Therefore, minimum thresholds at 50 feet below the ground surface may not protect shallow domestic wells in the subbasin. The GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold, and whether the undesirable results are consistent with the Human Right to Water policy.[9] In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs or drinking water users when defining undesirable results, nor does it describe how the groundwater levels minimum thresholds are consistent with Human Right to Water policy and will avoid significant and unreasonable impacts on beneficial users.

The minimum thresholds for degraded water quality for each of the four identified key water quality constituents (nitrate, arsenic, chloride, TDS) are based on the greater of MCLs or the baseline concentration plus 20%. According to the state's anti- degradation policy,[10] high water quality should be protected and is only allowed to worsen if a finding is made that it is in the best interest of the people of the State of California. No analysis has been done and no such finding has been made. Furthermore, exceedances of the MCL constitute a violation of the state's water quality law and are not permitted. Additionally, Section 2.2.2.3 of the GSP (Groundwater Quality) discusses other contaminants associated with cleanup sites that are distributed throughout the urban EBP subbasin. SMC should be established for all COCs in the subbasin impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

The GSP only includes a very general discussion of impacts on drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs or drinking water users when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs or drinking water users.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and drinking water users when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs and drinking water users within the subbasin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.

Degraded Water Quality

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality.[11] For specific guidance on how to

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

[10] Anti-degradation Policy https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf

[11] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[12]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users.
- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that are impacted or exacerbated by groundwater use and/or management.
- Set minimum thresholds that do not allow water quality to degrade to levels at or above the MCL trigger level.

<u>Groundwater Dependent Ecosystems and Interconnected Surface Waters</u>
For chronic lowering of groundwater levels, the GSP recognizes the potential impact of groundwater level minimum thresholds on GDEs. The minimum thresholds are established as follows (p. 3-7): *"In these areas* [Shallow Aquifer Zone at RMS wells located adjacent to GDEs]*, the initial interim MT for Shallow Aquifer Zone groundwater levels is set to 7.5 feet below existing/baseline conditions, and this will be updated (and potentially revised) pending additional hydrogeologic/ biologic data collection and studies."*

The GSP states (3-15): *"GDEs directly dependent on groundwater levels would not necessarily be protected by an MT that is protective of drinking water supply wells. Therefore, areas of the EBP Subbasin coinciding with known GDEs will have adjustments to the groundwater level MT established to protect drinking water supply wells. Additional work is needed in the early stages of GSP implementation to conduct further evaluation of potential GDEs, rooting depths of various species, and how declines in groundwater levels may impact various potential GDE vegetative species."* The GSP continues (p. 3-19): *"If a 6-year drought and projected water level declines to MT levels were to occur, potential effects on GDEs could include short-term adverse impacts such as water stress and possibly longer-term impacts such as reduced growth and recruitment."* Therefore, while the GSP recognizes that there could be impacts on GDEs, no further details on these impacts are provided, such as which habitat types could be affected, or the anticipated physiological responses based on minimum threshold groundwater levels.

For depletion of interconnected surface water, groundwater elevations are used as proxy for establishing SMC. The GSP states (3-10): *"The MT for non-drought shallow groundwater levels (as a proxy) is set at two feet below current baseline water levels in the Water Table Aquifer Zone beneath the major creeks. This is considered an interim MT, and the MT will be refined with collection of additional data to improve the understanding of stream-aquifer connectivity and potential for streamflow depletion related to groundwater pumping."* The GSP notes that the proposed minimum thresholds require use of shallow wells along major creeks, which are planned to be installed for use as representative monitoring sites (RMSs). The interim MT are based on model estimated groundwater levels. While the GSP clearly recognizes the data gap for depletion of interconnected surface water SMC, we would like to see further discussion of how the interim SMC will affect beneficial users, and more specifically GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. The GSP makes no attempt to evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (see Attachment C for a list of

[12] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin.[13] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[14]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[15] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,16]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[17] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their

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[13] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[14] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[15] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[16] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[17] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

survival. Condon *et al*. (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[18] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors. However, the plan does not clearly specify which change factors were used (e.g., 2030 or 2070). Furthermore, the plan does not make clear whether multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) were considered in the projected water budget. The GSP should indicate which DWR change factors were used for the projected water budget and also clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP incorporates climate change into key inputs (e.g., precipitation, evapotranspiration, and sea level rise) of the projected water budget. However, imported water should also be adjusted for climate change and incorporated into the surface water flow inputs of the projected water budget. Furthermore, the GSP does not provide a sustainable yield based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of projected climate change effects on imported water inputs, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Clarify if extremely wet and dry scenarios are incorporated into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- If there are data available, expand your integration of climate change into surface water flow inputs, including imported water, for the projected water budget.
- Estimate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs and domestic wells in the subbasin.

[18] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

Figure 3-11 (Groundwater Quality RMS Wells) shows insufficient representation of DACs and drinking water users for water quality monitoring. Figure 3-15 (Shallow Aquifer Groundwater Level RMS Wells) shows insufficient representation of DACs and drinking water users for shallow groundwater elevation monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[19]

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, GDEs, and ISWs to clearly identify monitored areas.
- Increase the number of RMSs in the shallow aquifer across the subbasin as needed to adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMSs.
- Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient** due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

While Section 4.1.1 documents EBMUD's potable water injection facility, it fails to describe the project's explicit benefits or impacts to beneficial users, such as DACs. The plan also fails to include a domestic well mitigation program to avoid significant and unreasonable loss of drinking water.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

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[19] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

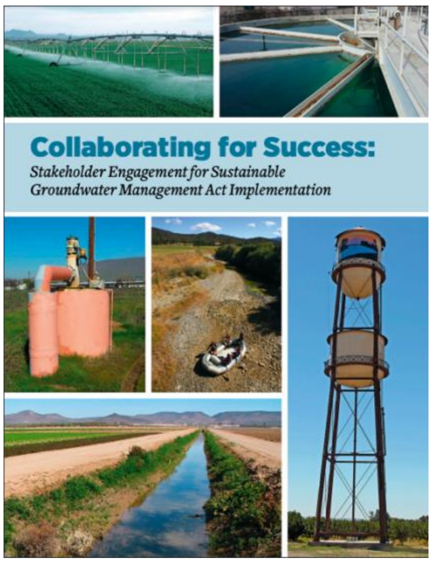
- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSAs plan to mitigate such impacts.
- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[20]
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[20] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



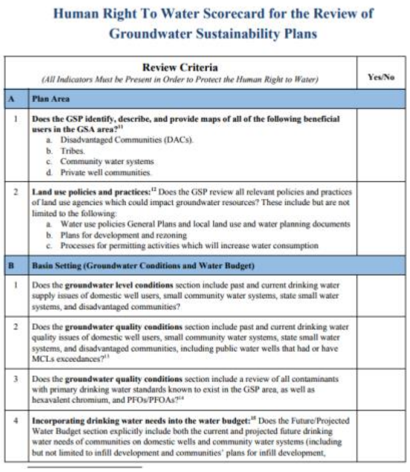
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

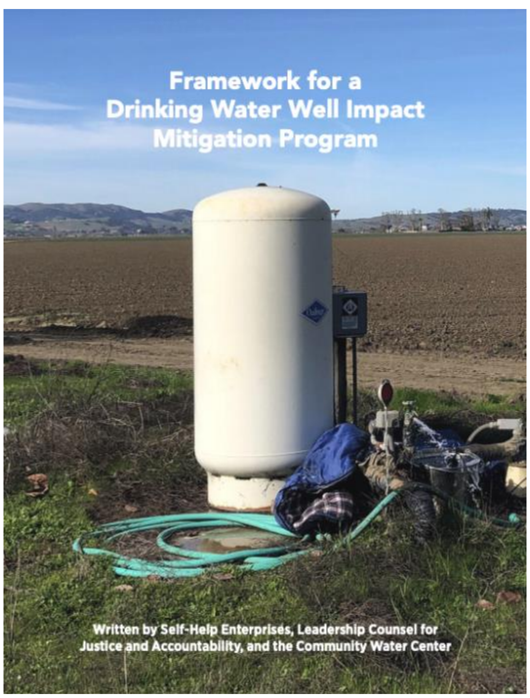


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

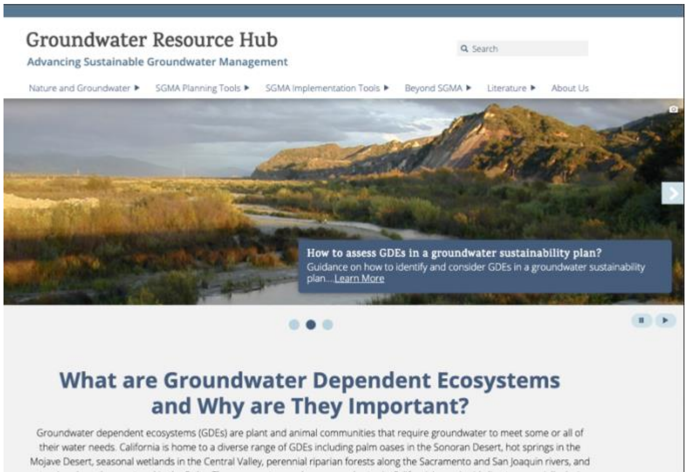
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



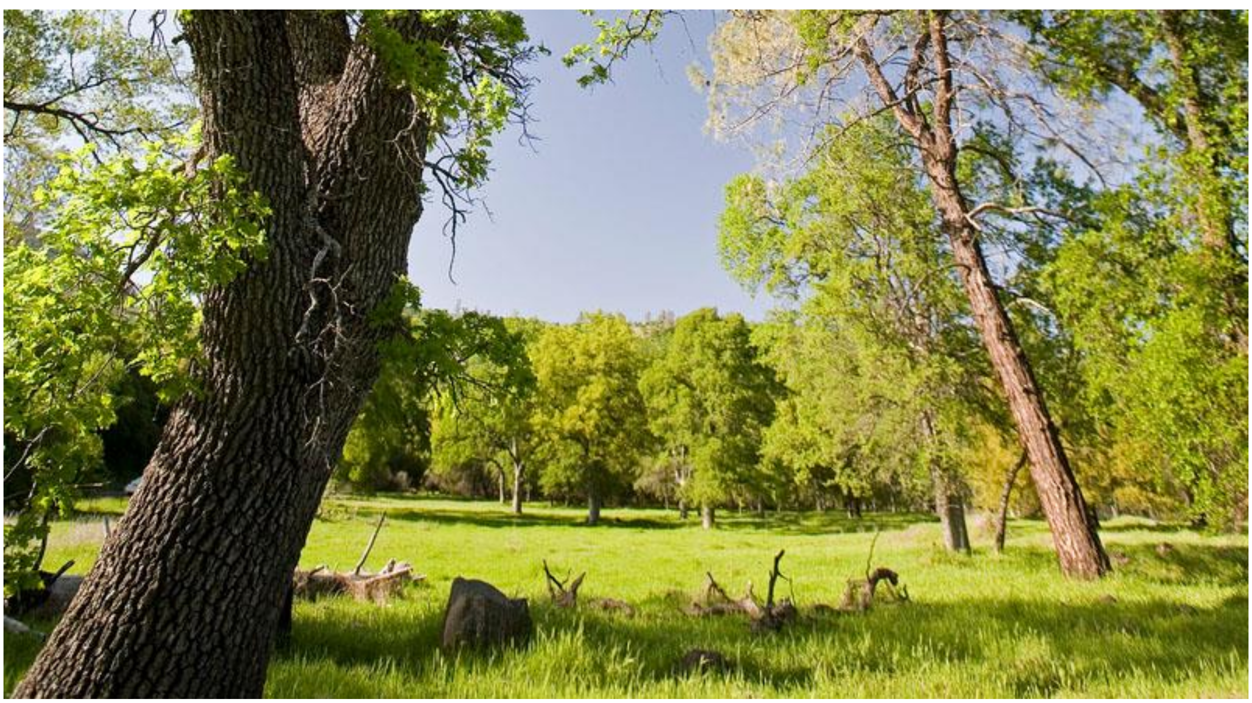
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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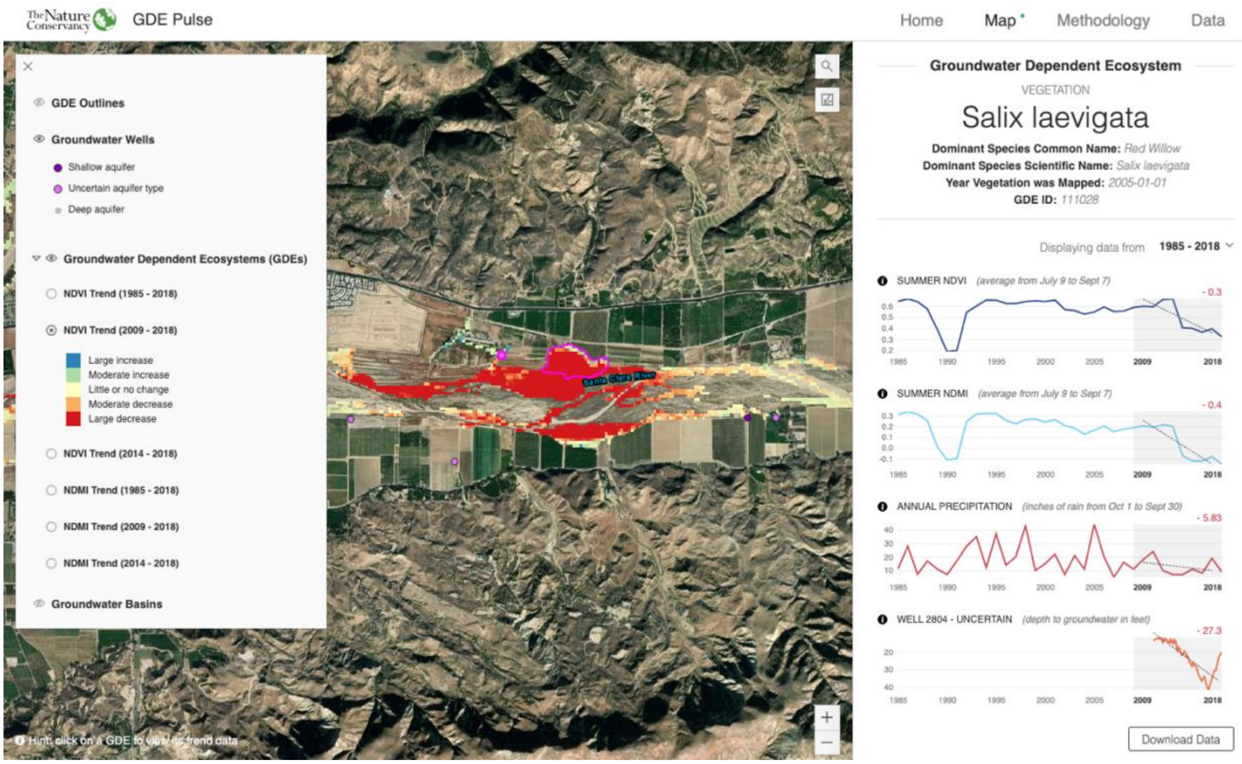
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

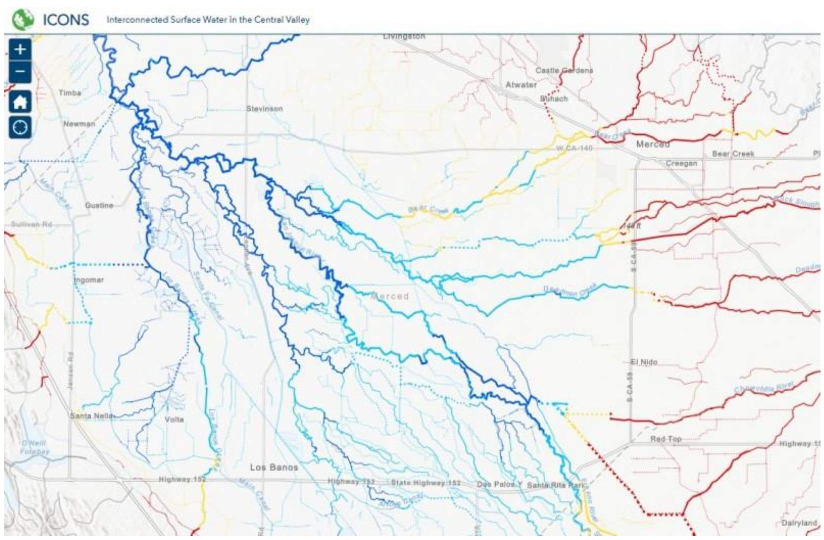
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Santa Clara Valley - East Bay Plain Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Santa Clara Valley - East Bay Plain Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Geothlypis trichas sinuosa	Saltmarsh Common Yellowthroat	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Laterallus jamaicensis coturniculus	California Black Rail	Bird of Conservation Concern	Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Coturnicops noveboracensis	Yellow Rail	Bird of Conservation Concern	Special Concern	BSSC - Second priority
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis canadensis	Lesser Sandhill Crane		Special Concern	BSSC - Third priority
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Histrionicus histrionicus	Harlequin Duck		Special Concern	BSSC - Second priority
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			

Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Pipilo aberti	Abert's Towhee			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Rynchops niger	Black Skimmer			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Americorophium spp.	Americorophium spp.			
Crangonyx spp.	Crangonyx spp.			
Cyprididae fam.	Cyprididae fam.			
Cyzicus californicus	California Clam Shrimp			
Gammarus spp.	Gammarus spp.			
Hyalella spp.	Hyalella spp.			
Pacifastacus spp.	Pacifastacus spp.			
Palaemon macrodactylus				Not on any status lists
Ramellogammarus spp.	Ramellogammarus spp.			
FISH				
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013

Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endangered	Endangered	Vulnerable - Moyle 2013
Spirinchus thaleichthys	Longfin smelt	Candidate	Threatened	Vulnerable - Moyle 2013
Oncorhynchus mykiss - CCC winter	Central California coast winter steelhead	Threatened	Special	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Anaxyrus boreas halophilus	California Toad			ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
Pseudacris sierra	Sierran Treefrog			
Thamnophis atratus atratus	Santa Cruz Gartersnake			Not on any status lists
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis elegans terrestris	Coast Gartersnake			Not on any status lists
Thamnophis ordinoides	Northwestern Gartersnake			ARSSC
INSECTS & OTHER INVERTS				
Abedus indentatus				Not on any status lists
Ablabesmyia spp.	Ablabesmyia spp.			
Aeshna walkeri	Walker's Darner			
Agabus disintegratus				Not on any status lists
Agabus spp.	Agabus spp.			
Alotanypus spp.	Alotanypus spp.			
Anax junius	Common Green Darner			
Apedilum spp.	Apedilum spp.			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetidae fam.	Baetidae fam.			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brillia spp.	Brillia spp.			

Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Conchapelopia spp.	Conchapelopia spp.			
Corisella spp.	Corisella spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Dicosmoecus pallicornis	A Caddisfly			
Dicrotendipes adnilus				Not on any status lists
Dicrotendipes spp.	Dicrotendipes spp.			
Dytiscidae fam.	Dytiscidae fam.			
Enallagma civile	Familiar Bluet			
Enochrus carinatus				Not on any status lists
Enochrus hamiltoni				Not on any status lists
Ephydridae fam.	Ephydridae fam.			
Eubrianax edwardsii				Not on any status lists
Gyrinus plicifer				Not on any status lists
Hydropsyche oslari	A Caddisfly			
Hydroptila ajax	A Caddisfly			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ischnura cervula	Pacific Forktail			
Ischnura gemina	San Francisco Forktail		Special	IUCN - Vulnerable
Ischnura perparva	Western Forktail			
Lepidostoma spp.	Lepidostoma spp.			
Lestes stultus	Black Spreadwing			
Lestidae fam.	Lestidae fam.			
Libellula pulchella	Twelve-spotted Skimmer			
Malenka spp.	Malenka spp.			
Metriocnemus spp.	Metriocnemus spp.			
Micropsectra spp.	Micropsectra spp.			
Mystacides alafimbriatus	A Caddisfly			
Narpus spp.	Narpus spp.			
Neophylax rickeri	A Caddisfly			
Nereis spp.	Nereis spp.			
Optioservus spp.	Optioservus spp.			
Orthocladius appersoni				Not on any status lists
Orthocladius spp.	Orthocladius spp.			
Oxyethira spp.	Oxyethira spp.			

Paltothemis lineatipes	Red Rock Skimmer			
Pantala flavescens	Wandering Glider			
Pantala hymenaea	Spot-winged Glider			
Paraleptophlebia spp.	Paraleptophlebia spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Paratendipes spp.	Paratendipes spp.			
Pentaneura inconspicua				Not on any status lists
Pentaneura spp.	Pentaneura spp.			
Phaenopsectra dyari				Not on any status lists
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Psectrotanypus spp.	Psectrotanypus spp.			
Psychodidae fam.	Psychodidae fam.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Rhyacophila spp.	Rhyacophila spp.			
Sialis spp.	Sialis spp.			
Sigara spp.	Sigara spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sperchon stellata				Not on any status lists
Sperchontidae fam.	Sperchontidae fam.			
Sympetrum corruptum	Variegated Meadowhawk			
Sympetrum illotum	Cardinal Meadowhawk			
Sympetrum pallipes	Striped Meadowhawk			
Tanypus spp.	Tanypus spp.			
Tanytarsus spp.	Tanytarsus spp.			
Trichocorixa spp.	Trichocorixa spp.			
Zavrelimyia spp.	Zavrelimyia spp.			
MAMMALS				
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Pomatiopsis californica	Pacific Walker		Special	E
Anodonta californiensis	California Floater		Special	
Assiminea californica				Not on any status lists
Ferrissia fragilis	Fragile Ancylid			CS
Ferrissia spp.	Ferrissia spp.			

Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus circumstriatus	Disc Gyro			CS
Gyraulus spp.	Gyraulus spp.			
Helisoma spp.	Helisoma spp.			
Hydrobiidae fam.	Hydrobiidae fam.			
Lymnaea spp.	Lymnaea spp.			
Margaritifera falcata	Western Pearlshell		Special	
Menetus opercularis	Button Sprite			CS
Menetus spp.	Menetus spp.			
Physa spp.	Physa spp.			
Physella propinqua	Rocky Mountain Physa			CS
Pisidium casertanum				Not on any status lists
Pisidium spp.	Pisidium spp.			
Planorbidae fam.	Planorbidae fam.			
Pyrgulopsis stearnsiana	Yaqui Springsnail			T
Sphaeriidae fam.	Sphaeriidae fam.			
Sphaerium spp.	Sphaerium spp.			
Stagnicola elodes	Marsh Pondsnail			CS
PLANTS				
Alisma triviale	Northern Water-plantain			
Alnus rubra	Red Alder			
Arundo donax	NA			
Azolla filiculoides	NA			
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Carex densa	Dense Sedge			
Carex nebrascensis	Nebraska Sedge			
Carex nudata	Torrent Sedge			
Carex obnupta	Slough Sedge			
Carex senta	Western Rough Sedge			
Castilleja miniata miniata	Greater Red Indian-paintbrush			
Chloropyron maritimum palustre			Special	CRPR - 1B.2
Cicendia quadrangularis	Oregon Microcala			
Cotula coronopifolia	NA			
Darmera peltata	Umbrella Plant			
Eleocharis macrostachya	Creeping Spikerush			
Elodea canadensis	Broad Waterweed			
Eryngium aristulatum aristulatum	California Eryngo			
Euthamia occidentalis	Western Fragrant Goldenrod			

Glyceria leptostachya	Slim-head Mannagrass			
Helenium puberulum	Rosilla			
Isolepis cernua	Low Bulrush			
Jaumea carnosa	Fleshy Jaumea			
Juncus effusus effusus	NA			
Juncus lescurii				Not on any status lists
Juncus phaeocephalus paniculatus	Brownhead Rush			
Juncus phaeocephalus phaeocephalus	Brown-head Rush			
Juncus xiphioides	Iris-leaf Rush			
Lasthenia conjugens	Contra Costa Goldfields	Endangered	Special	CRPR - 1B.1
Lepidium oxycarpum	Sharp-pod Pepper-grass			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limonium californicum	California Sea-lavender			
Limosella acaulis	Southern Mudwort			
Ludwigia peploides peploides	NA			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Oenanthe sarmentosa	Water-parsley			
Panicum dichotomiflorum	NA			
Paspalum distichum	Joint Paspalum			
Perideridia kelloggii	Kellogg's Yampah			
Persicaria lapathifolia				Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phacelia distans	NA			
Phragmites australis australis	Common Reed			
Phyla nodiflora	Common Frog-fruit			
Plagiobothrys chorisianus	NA		Special	CRPR - 1B.2
Plagiobothrys glaber	Hairless Allocarya		Special	CRPR - 1A
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			

Pleuropogon californicus californicus				Not on any status lists
Pogogyne douglasii	NA			
Polygonum marinense	Marin Knotweed		Special	CRPR - 3.1
Populus trichocarpa	NA			Not on any status lists
Psilocarphus tenellus	NA			
Ranunculus repens	NA			
Rumex californicus				Not on any status lists
Rumex conglomeratus	NA			
Rumex crassus				Not on any status lists
Rumex occidentalis				Not on any status lists
Rumex salicifolius salicifolius	Willow Dock			
Ruppia maritima	Ditch-grass			
Salix exigua exigua	Narrowleaf Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Scirpus microcarpus	Small-fruit Bulrush			
Sequoia sempervirens				
Sidalcea neomexicana	Rocky Mountain Checker-mallow		Special	CRPR - 2B.2
Sinapis alba	NA			
Spartina densiflora	NA			
Spartina foliosa	California Cordgrass			
Spiranthes romanzoffiana	Hooded Ladies'-tresses			
Spirodela polyrhiza	NA			
Stachys ajugoides	Bugle Hedge-nettle			
Suaeda californica	California Sea-blite	Endangered	Special	CRPR - 1B.1
Symphyotrichum frondosum	Alkali Aster			
Symphyotrichum lentum	Suisun Marsh Aster		Special	CRPR - 1B.2
Triglochin maritima	Common Bog Arrow-grass			
Triglochin striata	Three-ribbed Arrow-grass			
Veronica americana	American Speedwell			
Zannichellia palustris	Horned Pondweed			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

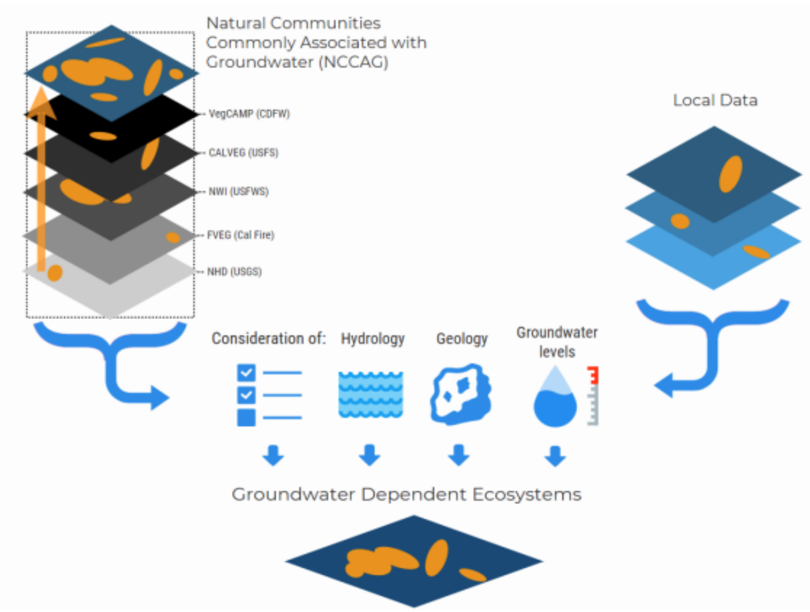


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

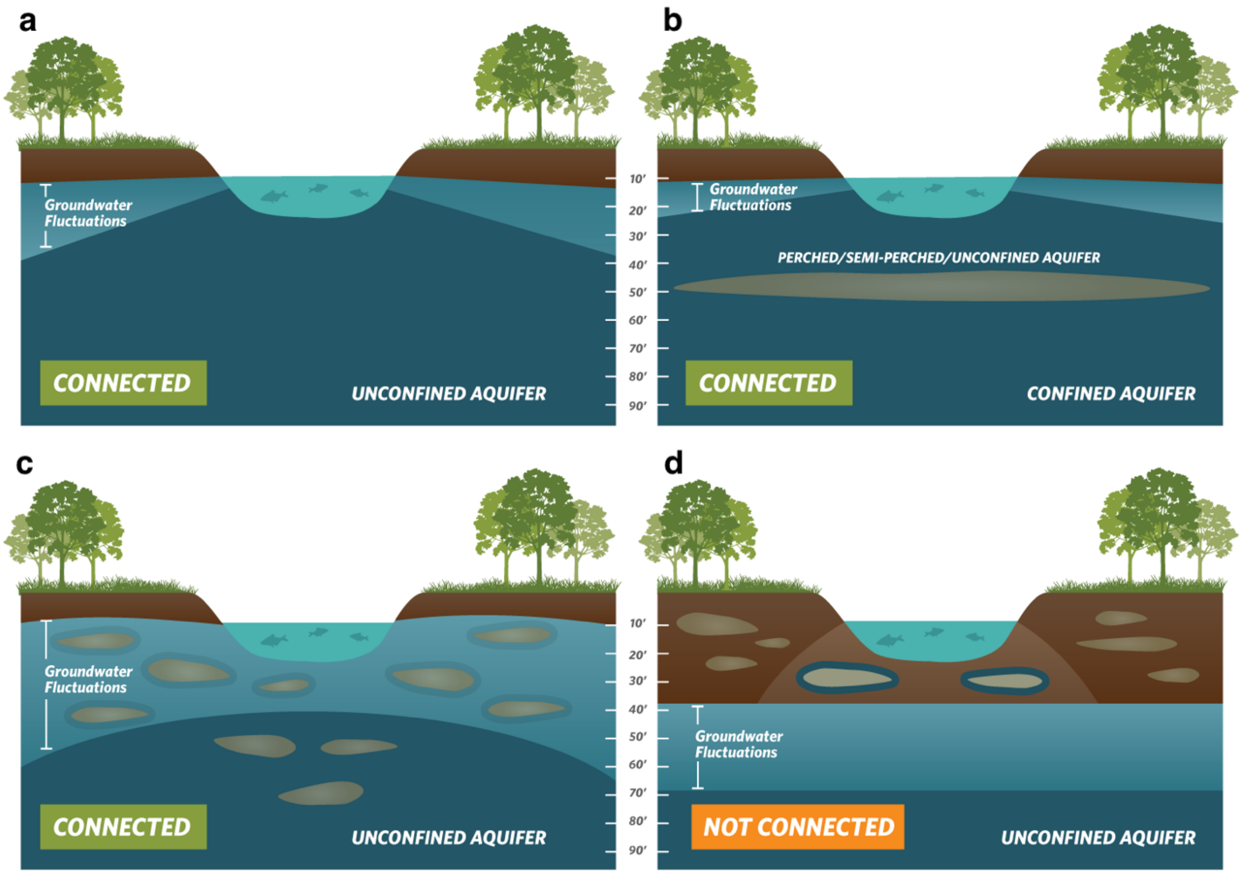


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

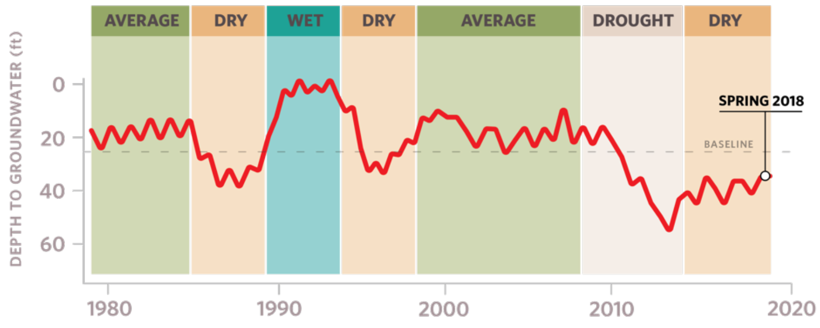


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

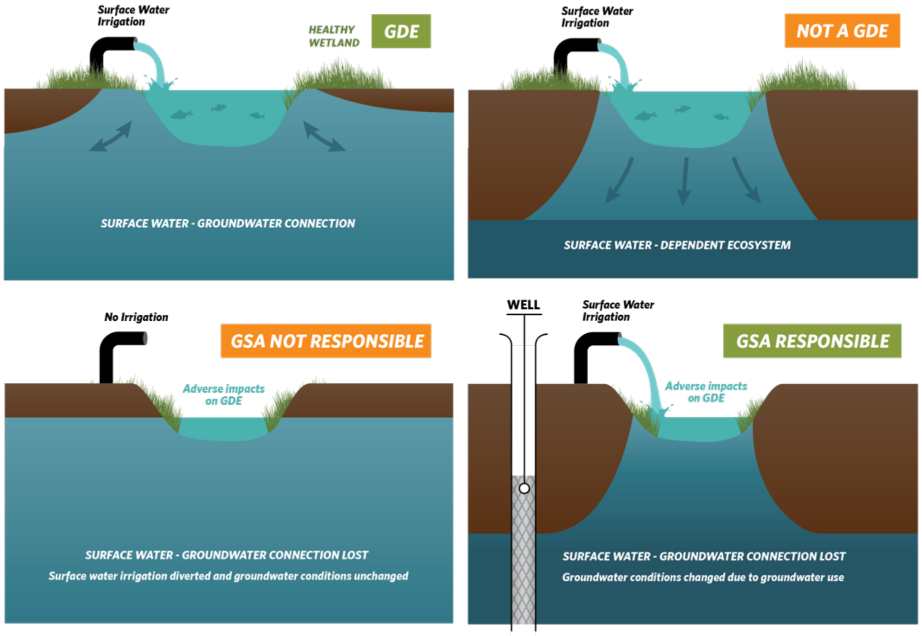


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

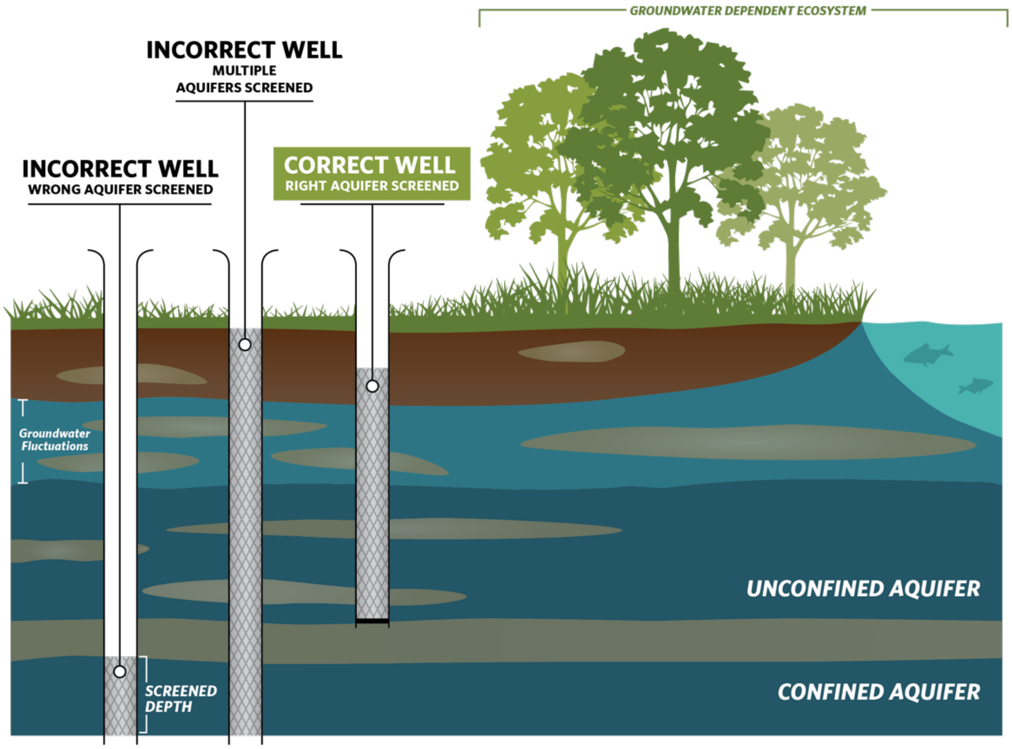


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

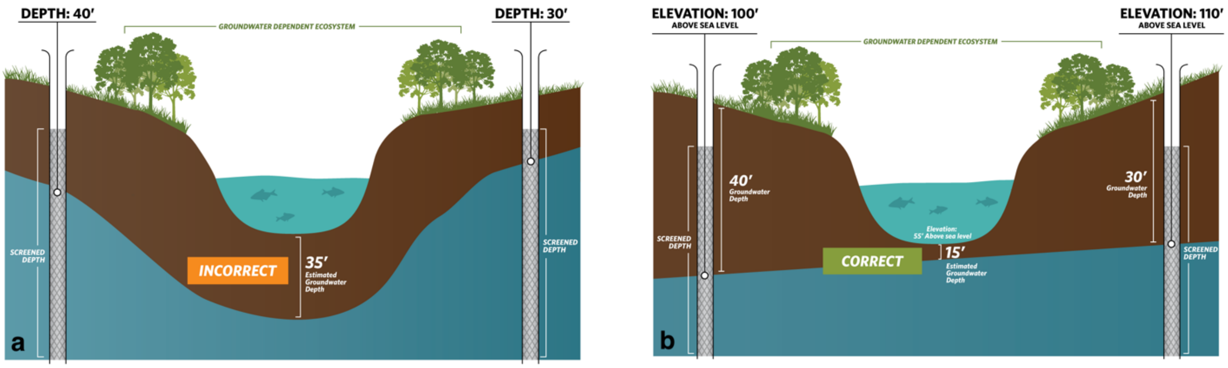


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

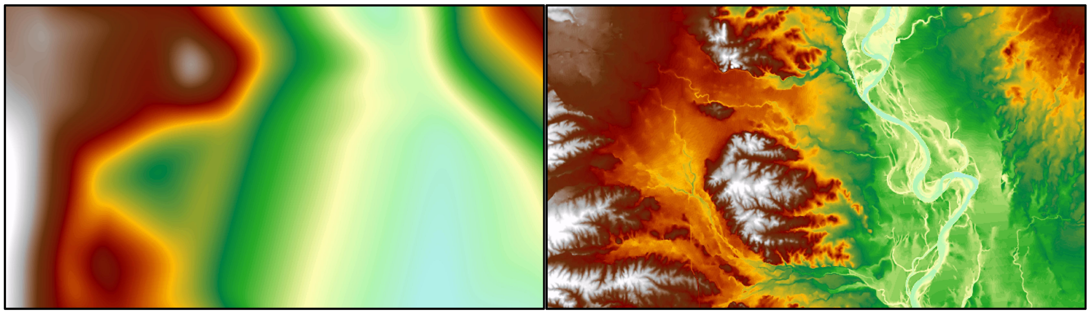


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

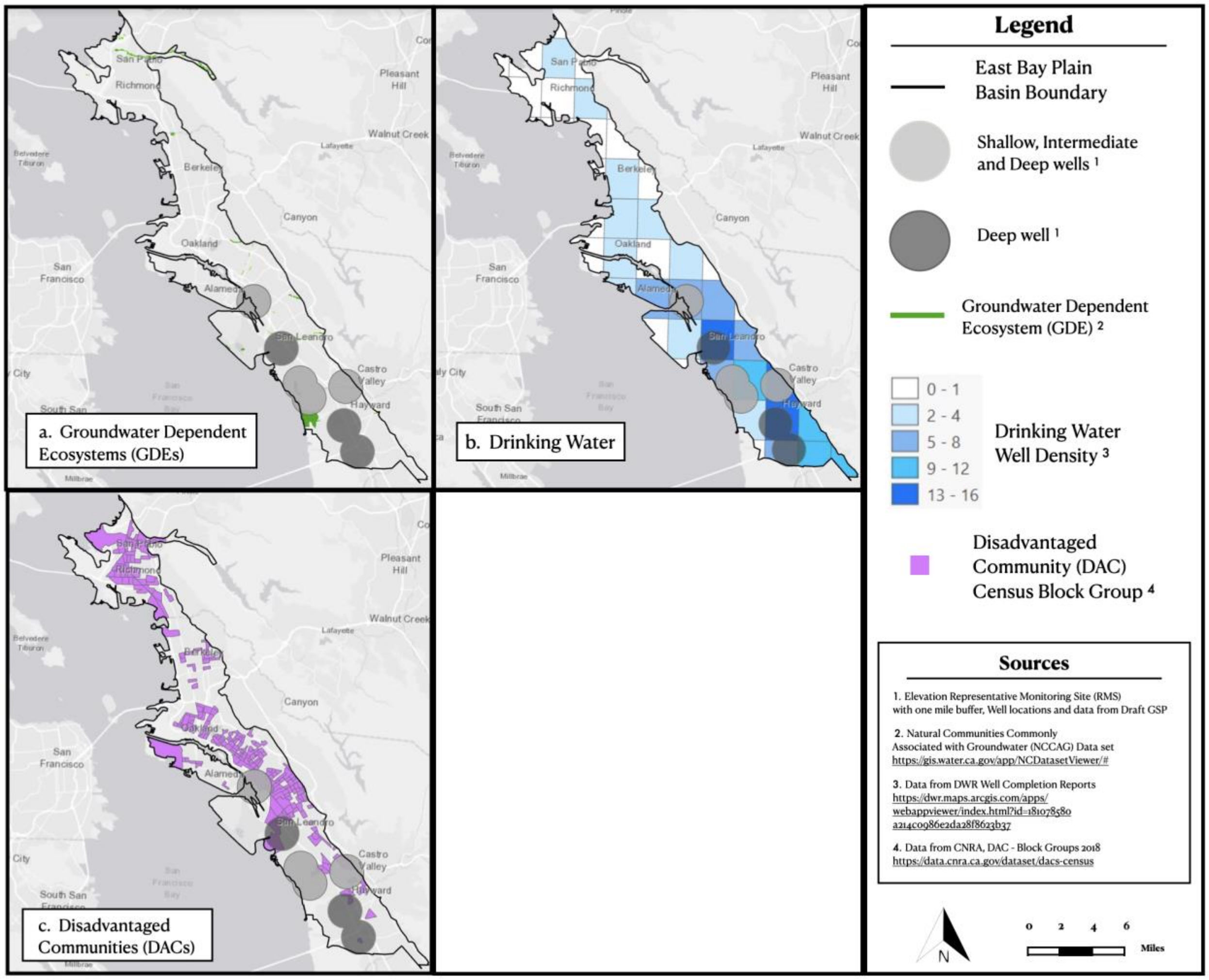


Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

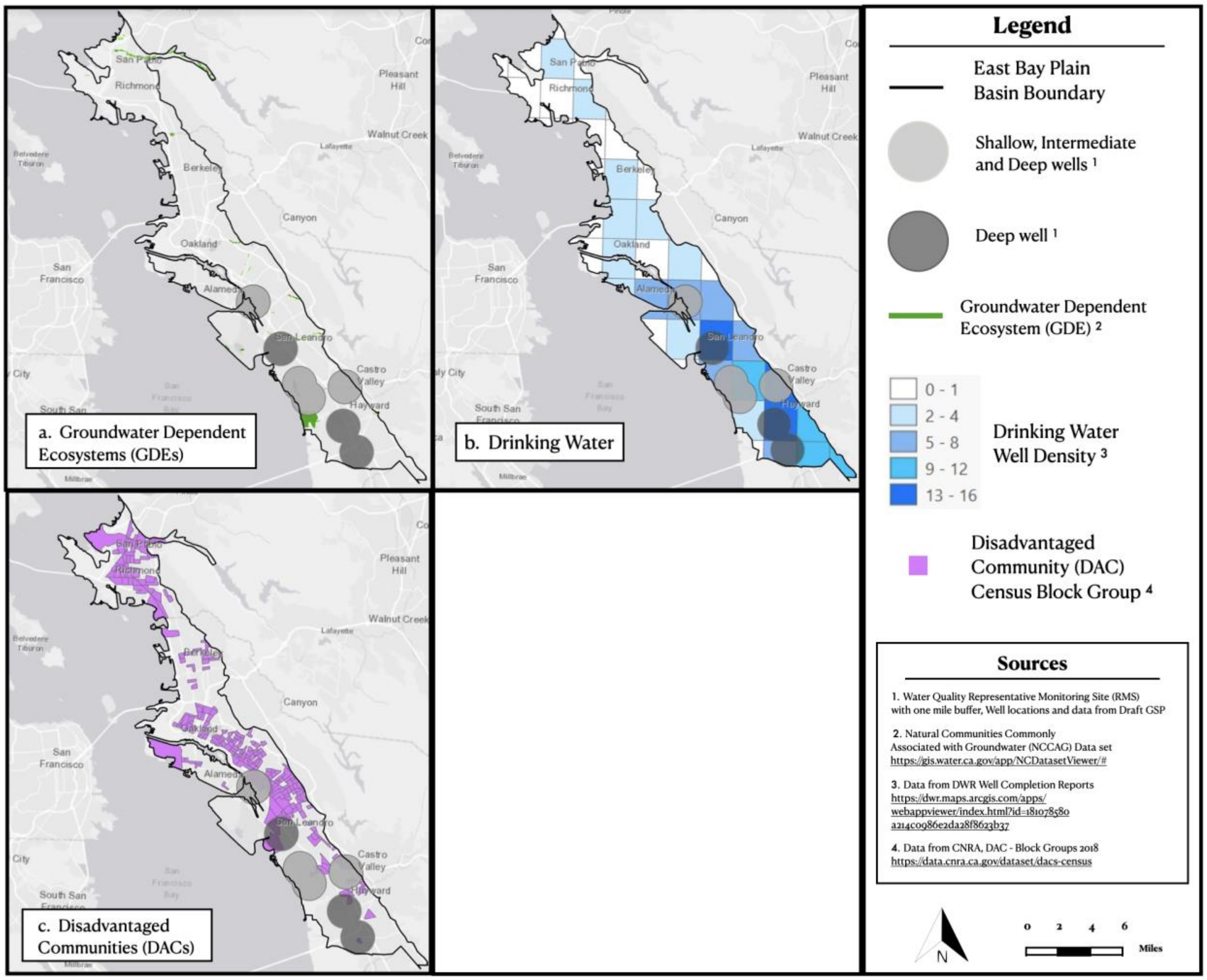


Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

October 6, 2021

East Contra Costa Groundwater Sustainability Agencies (GSAs)

Submitted via email: groundwaterinfo@dcd.cccounty.us

Re: Public Comment Letter for East Contra Costa Subbasin Draft GSP

Dear James Wolfe,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the East Contra Costa Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have some concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the East Contra Costa Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
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Attachment A

Specific Comments on the East Contra Costa Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **sufficient**. The GSP identified and mapped each DAC and Severely Disadvantaged Community (SDAC) and described the population of each. The water sources for DACs and SDACs were identified in Section 2 of the GSP. The GSP provides maps and graphs of domestic well density and depths in the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. For example, groundwater levels from only 2018 are included, and while these data are considered “conservative” because it was a wet water year, the temporal variability in gaining, losing and disconnected reaches are not incorporated. Note the GSP Regulations [23 CCR § 354.16(f)] state that plans should include “Identification of interconnected surface water systems within the basin and an estimate of the quantity and timing of depletions of those systems”. Thus, using groundwater elevation data from multiple years is essential to identify ISWs.

RECOMMENDATIONS
• On the depth to shallow groundwater map (Figure 3-25a), the title of the figure (depth to groundwater) contradicts the legend label (groundwater elevation). Also, the figure title says 2012 but the text refers to spring 2018 depth to groundwater. Correct the figure and text as needed. • Overlay the stream reaches shown with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. For the depth-to-groundwater contour maps, use the best practices presented in Attachment C. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.
- On the ISW map (Figure 3-25b), clearly label the areas with data gaps. While the GSP discusses data gaps in the text, we recommend that the GSP considers any segments with data gaps as potential ISWs and clearly marks them as such on maps provided in the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **sufficient**. The GSP identified and mapped GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources. The GSP acknowledges that groundwater level data is lacking in some of the western areas of the subbasin and thus did not make changes to the NC dataset, except to eliminate small acreage with agricultural or urban land use. The GSP discusses shallow zone data gaps near GDEs. Table 3-4 presents the vegetation species in the subbasin and Figure 3-27 maps the critical habitat in the subbasin. The GSP used The Nature Conservancy's (TNC's) GDE Pulse Tool to evaluate GDE health.

The GSP mentions using a depth threshold to analyze GDEs, but does not use it to eliminate them. The GSP states (p. 3-66): "Further analysis of GDEs in ECC was conducted by identifying areas where depth to groundwater is greater than 30 feet, the general vegetation maximum rooting depth." While we recommend using a 30-foot depth threshold when identifying GDEs, utilize a deeper threshold for plants with greater rooting depths (e.g., 80-foot threshold for valley oak, *Quercus lobata*). See Attachment B of this letter for more information on this and other tools to help address beneficial users of groundwater.

RECOMMENDATION

- Refer to Attachment B for more information on TNC's plant rooting depth database. Utilize a deeper threshold for plants with greater rooting depths (e.g., 80-foot threshold for valley oak (*Quercus lobata*).

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included into the water budget. The integration of these ecosystems into the water budget is **insufficient**. The water budget did explicitly include the current, historical, and projected demands of native vegetation, but did not include the current, historical, and projected demands of managed wetlands. Managed wetlands are not mentioned in the GSP, but are present in DWR's statewide cropping dataset. The omission of explicit water demands for managed wetlands is problematic because key environmental uses of groundwater are not being accounted for as water supply

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[1] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[2] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

decisions are made using this budget, nor will they likely be considered in project and management actions.

RECOMMENDATION
● Discuss and map the presence of managed wetlands in the subbasin. Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including managed wetlands.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the Communication and Engagement Plan (Appendix 10C). The opportunities for public involvement and engagement for DACs and environmental stakeholders during the GSP development and implementation processes are described in very general terms. They include outreach surveys, board meetings and workshops, speaking engagements, and press releases. The plan mentions messages developed and tailored to DACs, domestic well owners, and environmental stakeholders, but details on what the messaging entails and the nature of the engagement process are not provided in the Communication and Engagement Plan.

RECOMMENDATION
● In the Communication and Engagement Plan, describe active and targeted outreach to engage DAC members and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[4] and establishing minimum thresholds.[5,6]

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[3] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

[4] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[5] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[6] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP considers drinking water users when establishing SMC. Figure 7-3 presents the minimum top of screened interval for domestic wells, plotted by square mile section. The established minimum thresholds consider the undesirable result of dropping below the top perforations of domestic wells per section. The GSP does not however, specifically analyze direct and indirect impacts on DACs or evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs.

The GSP identifies the following as constituents of concern (COCs) in the subbasin: total dissolved solids (TDS), nitrate, chloride, arsenic, boron, and mercury. Water quality standards are provided as the following (Table 7-3): maximum contaminant level (MCL) for nitrate, arsenic, and mercury; secondary MCL for TDS and chloride; and the US EPA Health Advisory for non-cancer health effect for boron.

The GSP states (p. 7-24): "The minimum threshold at a given RMS in the ECC Subbasin is the three-year running average exceedance of an MCL for a key monitoring constituent." This is not an adequate methodology for establishing a minimum threshold since concentrations averaged over three years can not adequately detect impacts to beneficial users of groundwater.

For degraded water quality, the GSP only includes a very general discussion of impacts to drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels (in addition to describing impacts to drinking water users).

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users and DACs when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[7]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users and DACs.

- Set minimum thresholds that are based on individual exceedances of regulatory standards, not based on a 3-year running average.

[7] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP only considers GDEs with respect to the depletion of interconnected surface water sustainability indicator, but not the chronic lowering of groundwater levels sustainability indicator. No analysis or discussion is provided in the GSP that describes impacts to GDEs or establishes SMC for GDEs that are directly dependent on groundwater. This is problematic because without identifying potential impacts to GDEs, minimum thresholds may compromise these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC for chronic lowering of groundwater levels.

Sustainable management criteria for depletion of interconnected surface water are established based on groundwater flow model results. However, the GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[8] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[9] can be determined.

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached[10]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,11].

[8] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[9] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[10] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[11] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[12] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2070. However, the GSP did not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

The GSP includes climate change into precipitation, evapotranspiration, surface water flow, and sea level terms of the projected water budget. The GSP does not adjust imported water for climate change within the projected water budget. The sustainable yield is calculated based on the projected pumping with climate change incorporated. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios and exclusion of imported water with climate change incorporated, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change into imported water inputs for the projected water budget.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs and domestic wells in the subbasin.

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[12] “Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow.” [23 CCR §354.18(e)]

Figure 6-2 (Representative Groundwater Level Monitoring Network) and Figure 6-5 (Representative Groundwater Quality Monitoring Network) show that no monitoring wells are located across portions of the subbasin near DACs and domestic wells. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[13].

The GSP provides comprehensive discussion of data gaps for GDEs and ISWs in Sections 6.2.2.5 (Plan to Fill Groundwater Level Data Gaps) and Section 6.2.6 (Interconnected Surface Water Monitoring Network).

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs and domestic wells to clearly identify potentially impacted areas. Increase the number of RMPs in the shallow aquifer across the subbasin as needed to adequately monitor all groundwater condition indicators. Prioritize proximity to DACs and drinking water users when identifying new RMPs.

- Describe the biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as

[13] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[14].

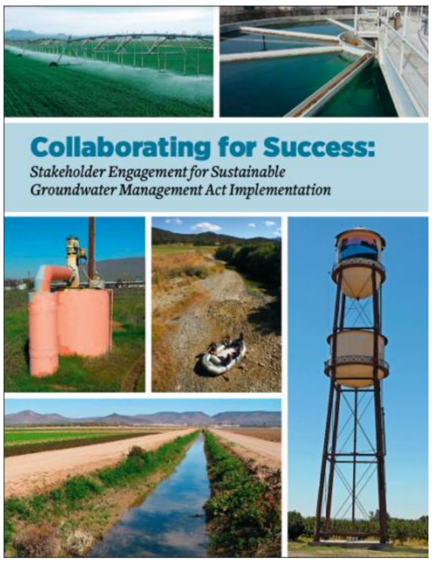
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[14] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



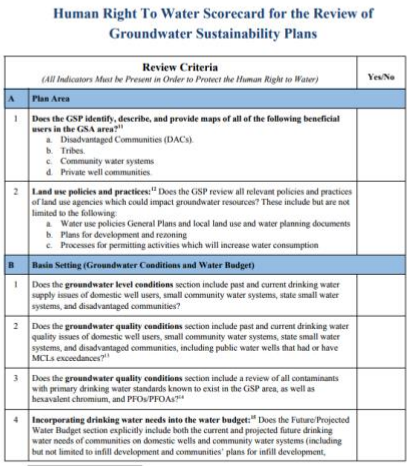
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

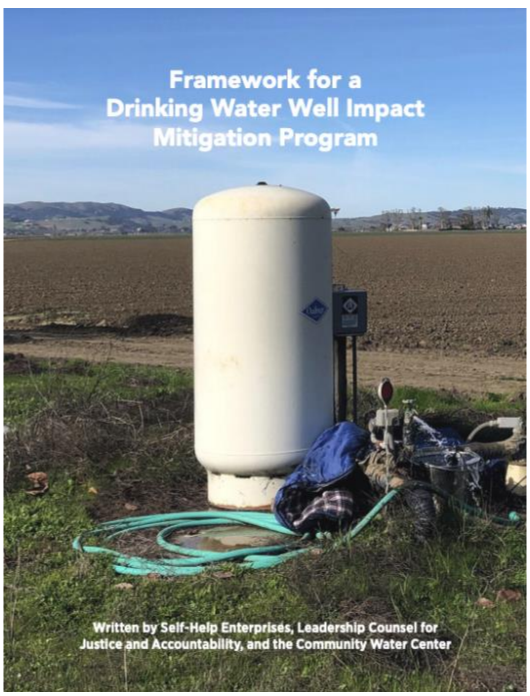
The Human Right to Water


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria (All Indicators Must be Present in Order to Protect the Human Right to Water)	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

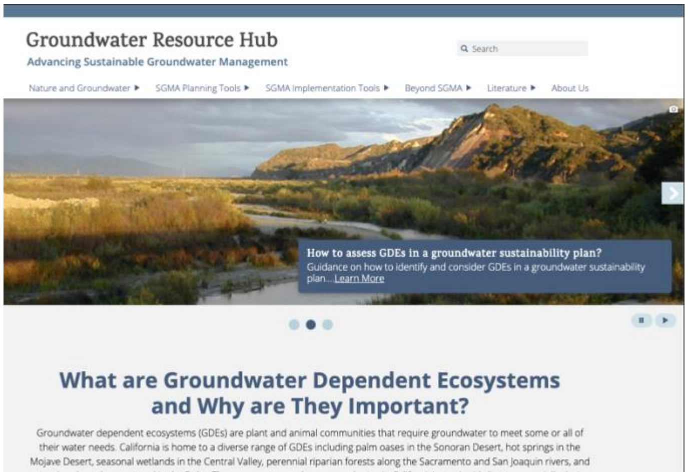
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



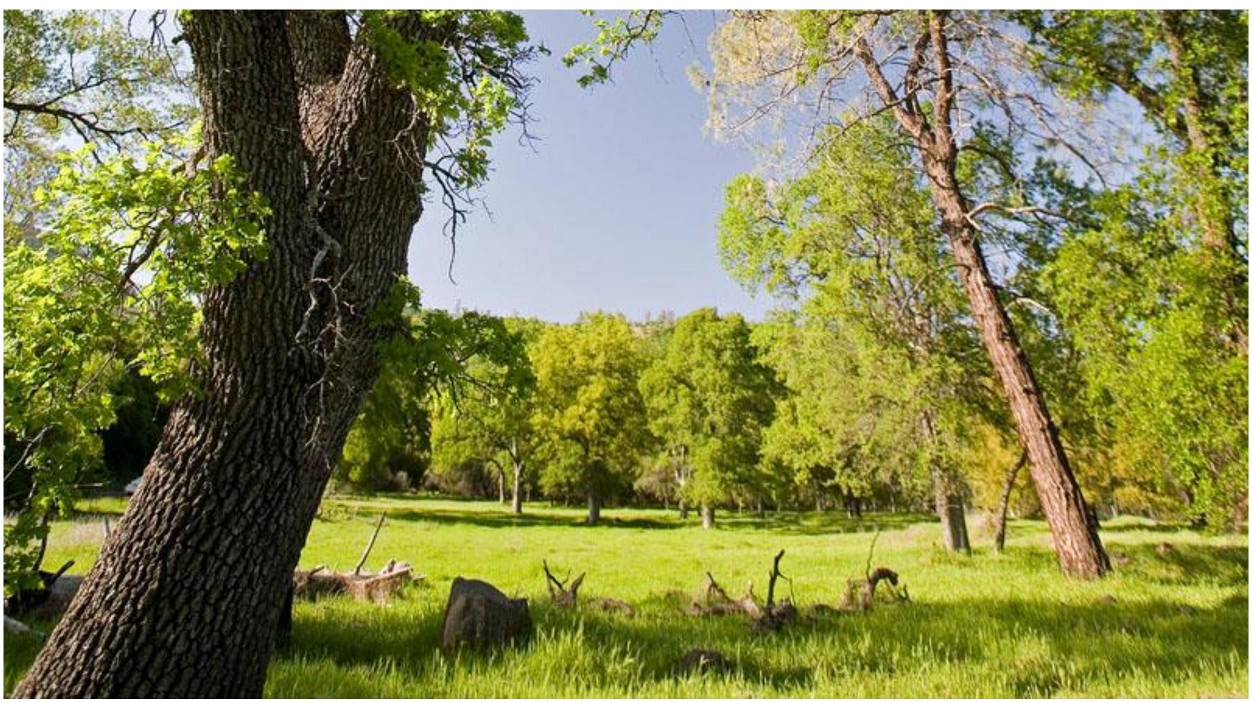
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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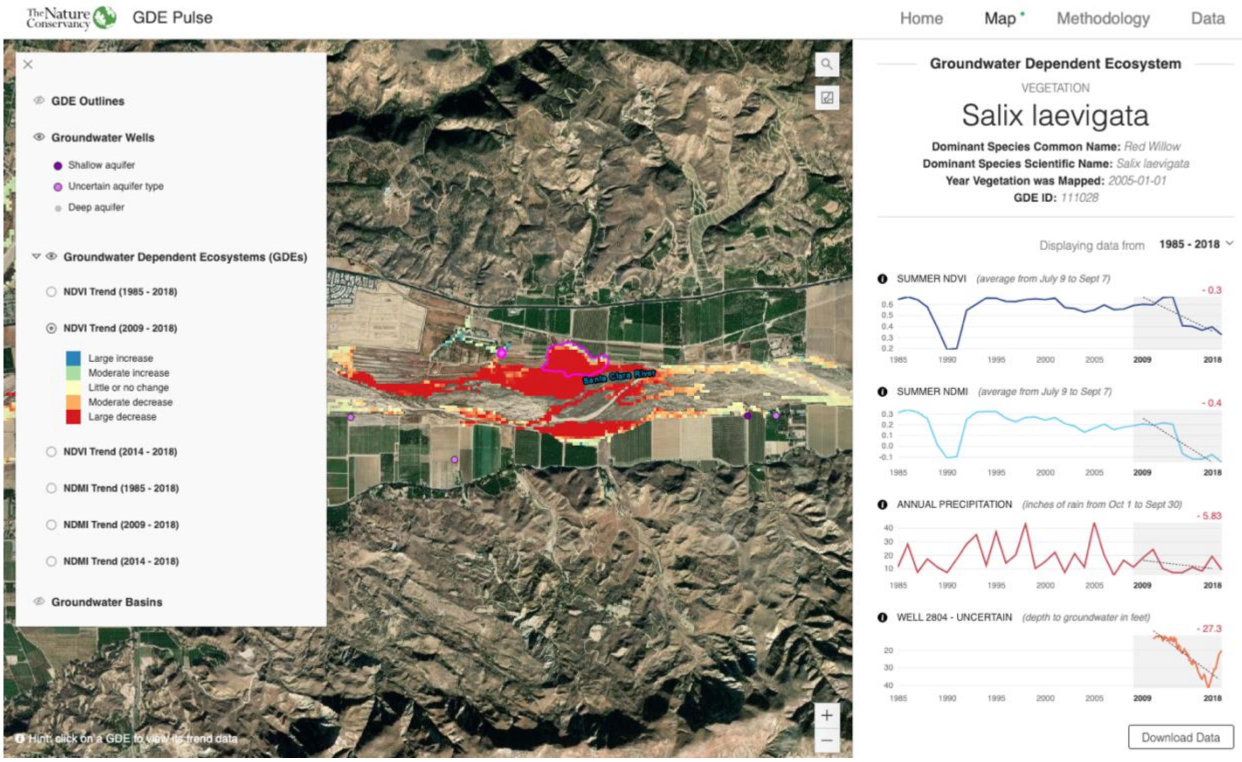
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

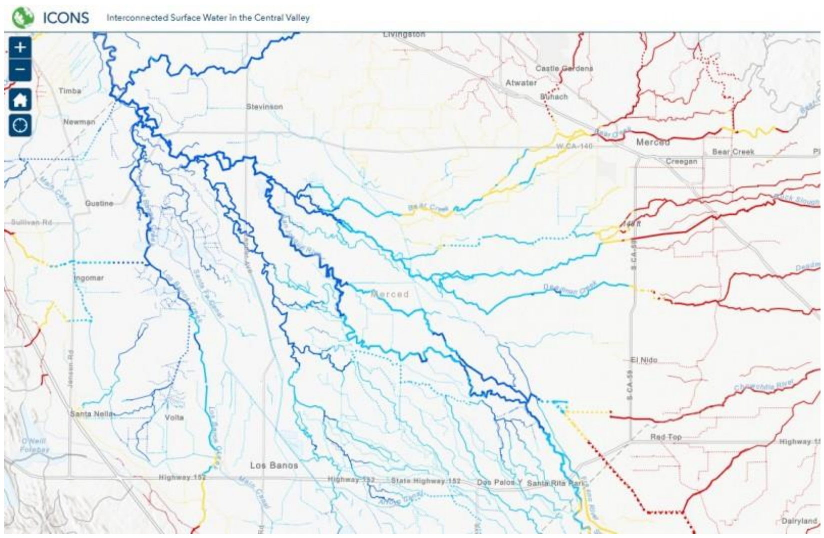
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

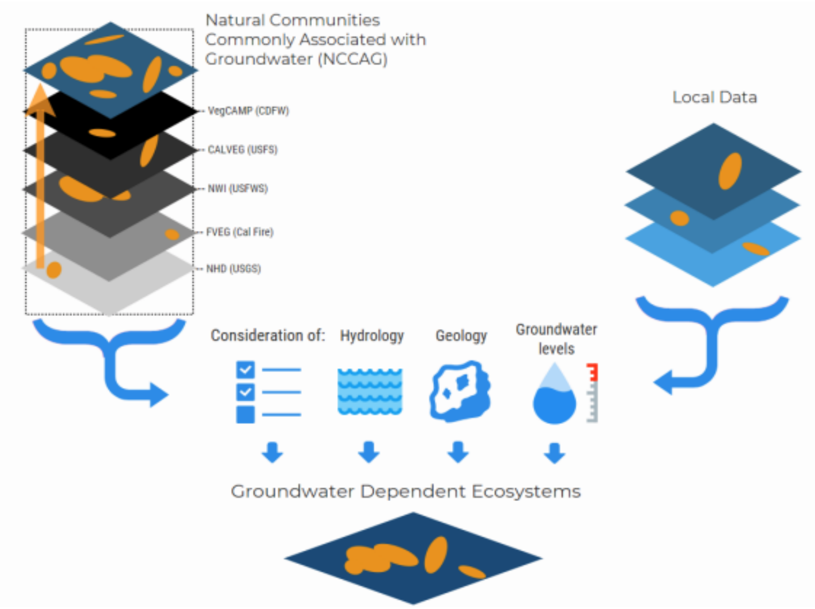


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

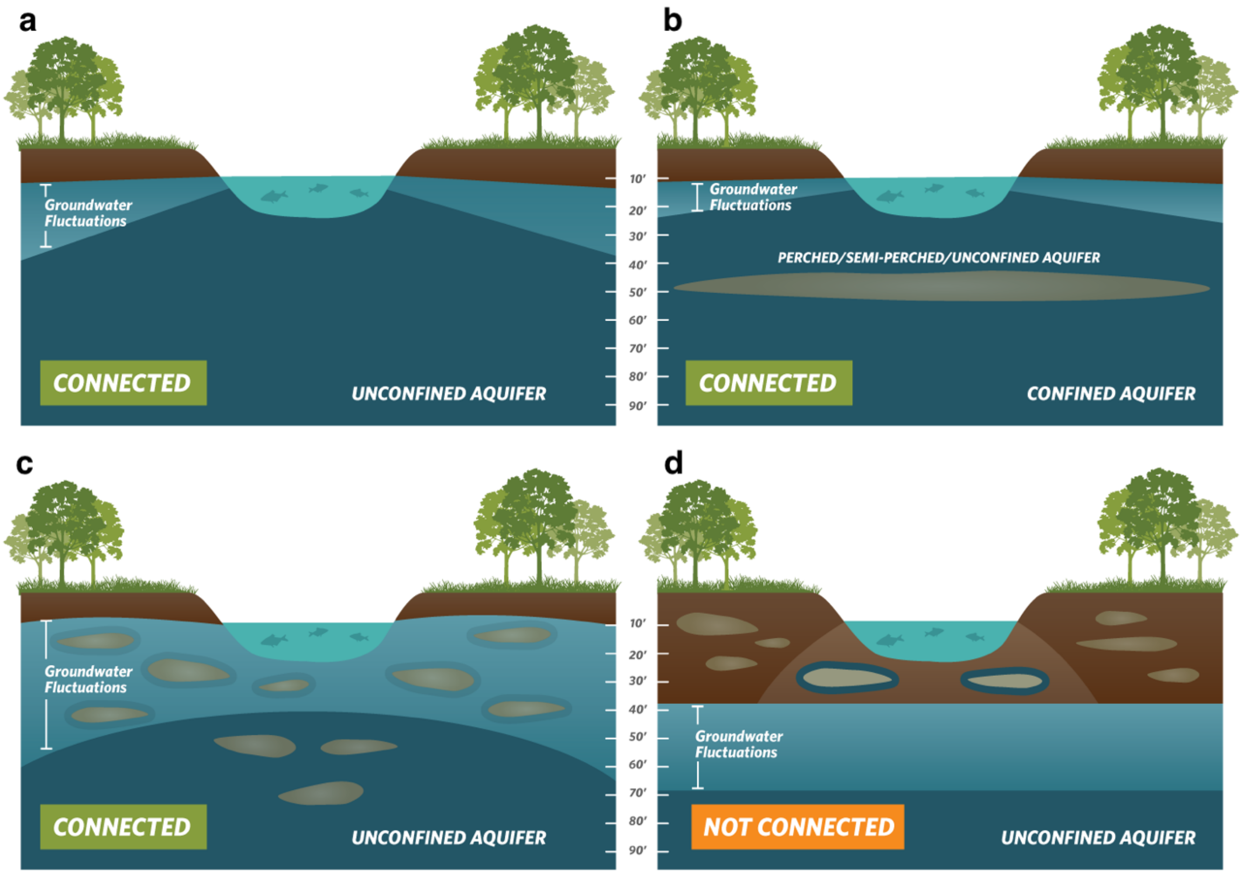


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

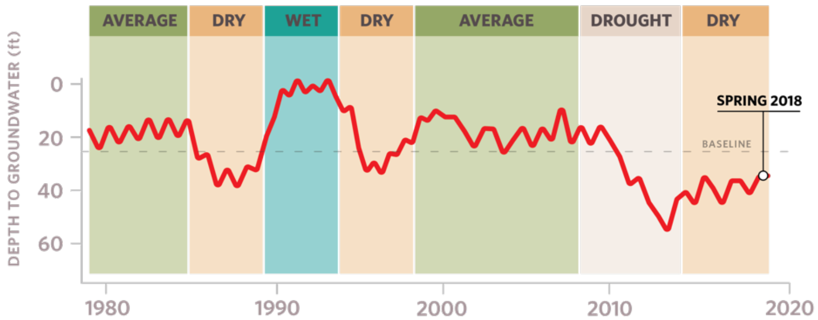


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

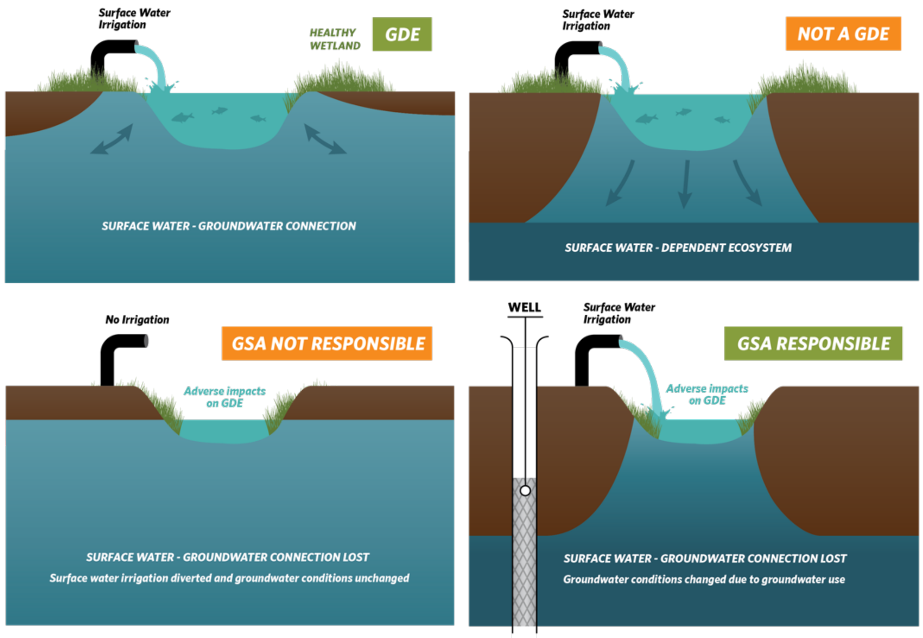

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

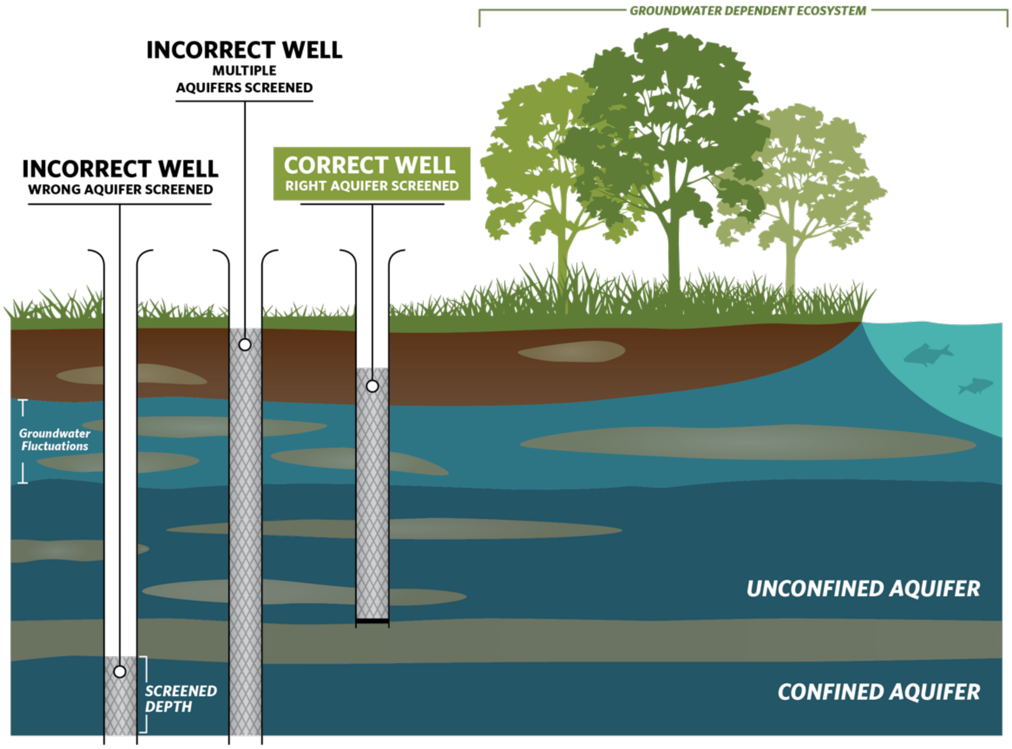

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

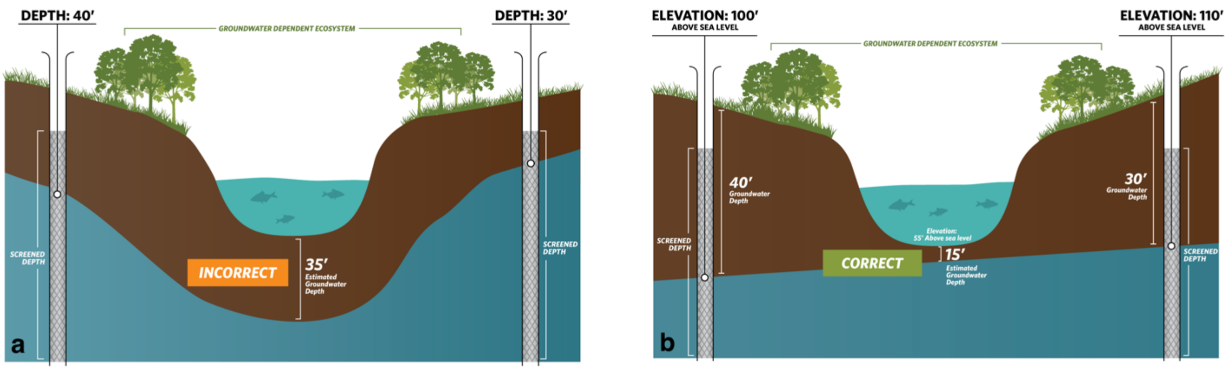

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

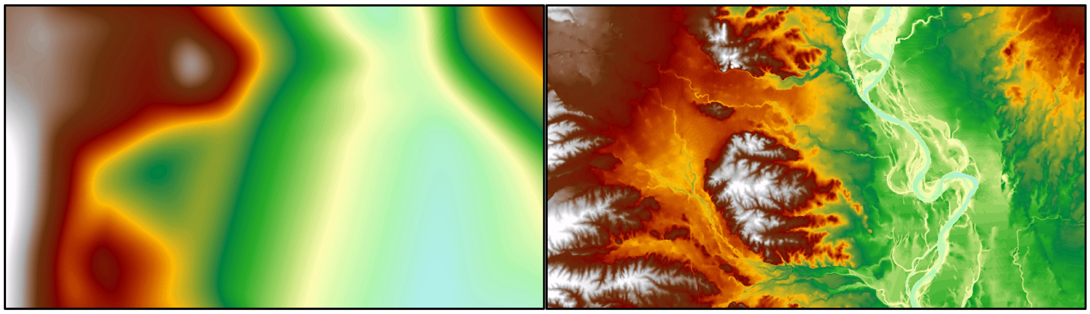

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

October 15, 2021

Salinas Valley Basin GSA
P.O. Box 1350
Carmel Valley, CA 93924

Submitted via web: https://form.jotform.com/201537036733047

Re: Public Comment Letter for the Eastside Aquifer Subbasin Draft GSP

Dear Donna Meyers,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Eastside Aquifer Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Eastside Aquifer Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
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The Nature Conservancy

Heather Lukacs, Ph.D.
Director of Community Solutions
Community Water Center

Justine Massey
Policy Manager and Attorney
Community Water Center

Attachment A

Specific Comments on the Eastside Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP provides information on DACs, including identification by name and location on a map (Figure 2-3), and identifying the water source for DAC members. However, the GSP fails to identify the population of each identified DAC.

The GSP provides a density map of domestic wells in the subbasin. However, the GSP fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS
• Include a map showing domestic well locations and average well depth across the subbasin. • Provide the population of each identified DAC.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **insufficient**, due to lack of supporting information provided for the ISW analysis. To assess ISWs, the GSP used the Salinas Valley Integrated Hydrologic Model (SVIHM). The GSP states (p. 4-23): "*Although seepage along the ISW reaches is based on assumed channel and aquifer parameters as model inputs, the preliminary SVIHM is the best available tool to estimate ISW locations. The model construction and uncertainty are described in Chapter 6 of this GSP.*" However, Chapter 6 of the GSP, the water budget chapter, presents very little information on the model. No further information in the GSP was presented providing description of the location of groundwater wells or stream gauges used in the analysis, or description of temporal (seasonal and interannual) variability of the data used to calibrate the model.

The GSP states (p. 4-23): *"The blue cells [in Figure 4-9] indicate areas where surface water is connected to groundwater for more than 50 percent of the number of months in the model period and are designated as areas of ISW. The clear cells represent areas that have interconnection less than 50 percent of the model period and require further evaluation to determine whether the SMC, discussed in Chapter 8, apply.*" Note the regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. The GSP states (p. 4-22): "*Interconnection between surface water and groundwater can vary both in time and space. A seasonal analysis is included in Appendix 4A.*" The appendix was not included in the public draft copy of the GSP, however.

RECOMMENDATIONS
• Describe available groundwater elevation data and stream flow data in the subbasin. ISWs are best analyzed using depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought), to determine the range of depth and capture the variability in environmental conditions inherent in California's climate. • Overlay the stream reaches shown on Figure 4-9 with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells in the subbasin used to create the contour maps. • For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. • On Figure 4-9 (Locations of Interconnected Surface Water), consider any modelled stream grid cells with >0% connection to groundwater as potential ISWs until more data is available. In other words, consider any stream cell with connection to groundwater for any length of time as a potential ISW. • Describe data gaps for the ISW analysis. Reconcile these data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of comprehensive, systematic analysis of the subbasin's GDEs.

The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources. The GSP does not discuss how the NC dataset was verified with the use of groundwater data, however. The GSP states (p. 4-27): *“The SVBGSA reviewed the NCCAG dataset and assessed each GDE’s potential connection to groundwater by determining if the GDE was underlain by shallow groundwater that has been delineated as being part of a Bulletin 118 principal aquifer, and if depth to groundwater is less than 30 feet.”* However, no further details are provided in the GSP. Based on the description provided in the GSP, it is unclear if Figure 4-10 (Groundwater Dependent Ecosystems) presents the entire NC dataset, or further analysis based on the 30 feet threshold as described in the text. Without an analysis of groundwater data to verify the NC dataset polygons, it will be difficult or impossible to adequately monitor and manage the subbasin’s GDEs throughout GSP implementation.

We commend the GSA for listing the threatened and endangered species likely to depend on groundwater, as determined from several sources including the US Fish and Wildlife Service (USFWS) website, California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDB), and TNC Critical Species LookBook (Table 4-1). Vegetation species present in the subbasin’s potential GDEs were not included in the GSP, however.

RECOMMENDATIONS

- Develop and describe a systematic approach for analyzing the subbasin’s GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained, removed, or added to/from the NC dataset (include the removal reason if polygons are not considered potential GDEs, or include the data source if polygons are added). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Refer to Attachment B for more information on TNC’s plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as valley oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- Please provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin (see Attachment C of this letter for a list of freshwater species located in the Eastside Subbasin).

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included in the water budget. The integration of native vegetation and managed wetlands into the water budget is **insufficient**. The water budget includes a separate item for evapotranspiration, but combines crop and riparian evapotranspiration into one term. The GSP states (p. 2-2): *"Environmental users include native vegetation and managed wetlands."* Managed wetlands are not mentioned further in the GSP and are not included in the water budgets, however. The omission of explicit water demands for native vegetation and managed wetlands is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

RECOMMENDATION

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation and managed wetlands.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **incomplete**. SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the Communication and Public Engagement section of the GSP (Chapter 2).

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1 "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

2 "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

3 "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

The GSA's outreach activities include conducting interviews with DAC community leaders to identify strategies to work together during GSP planning and implementation; conducting workshops with partners on water and groundwater sustainability; identifying concerns from DACs and underrepresented communities; planning listening sessions around GSA milestones; developing a resource hub with partner organizations; identifying community allies to partner with in reducing barriers to participation from DACs; and planning to convene a working group on domestic water that includes DACs and underrepresented communities. However, there is no specific pathway for feedback from DAC residents and representatives to be considered and included in the GSP and its implementation.

We note additional deficiencies with the overall stakeholder engagement process. While environmental organizations have a representative serving on the board of directors and are listed as stakeholders and as members of the GSP Advisory Committee, there is no specific outreach described that is directly targeted to environmental stakeholders during the GSP development and implementation processes.

RECOMMENDATIONS

- In the Communication and Public Engagement Plan, describe active and targeted outreach to engage environmental stakeholders during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.
- DAC and environmental stakeholder engagement should be improved by incorporating feedback and recommendations from DAC and environmental stakeholders engaged in the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[4] and establishing minimum thresholds.[5,6]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP discusses minimum thresholds impact on domestic wells (Section 8.6.2.2). The GSP states (p. 8-14): "*The analysis of domestic wells showed that in the Eastside Aquifer all domestic wells will have at least 25 feet of water in them as long as groundwater elevations remain above minimum thresholds*." However, the analysis was only based on 20 wells out of the total 206 domestic wells in the OSWCR database.

[4] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
[5] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[6] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Furthemore, the GSP states (p. 8-14): "*Some domestic wells may draw water from shallow, perched groundwater that is not managed in this GSP.*" The GSP states (p. 5-43): "*The Eastside Subbasin is considered a single aquifer with two generalized water-bearing zones*." The shallow perched zones are part of the single aquifer system and are still governed by the requirements of SGMA.

Section 8.6.4 defines undesirable results for the chronic lowering of groundwater level SMC. The GSP states (p. 8-22): *"The chronic lowering of groundwater levels undesirable result is: more than 15% of the groundwater elevation minimum thresholds are exceeded.*" However, undesirable results should inform the development of minimum thresholds, not the other way around. The GSP should establish minimum thresholds at the representative monitoring wells that account for the specific undesirable results the GSA has determined for the subbasin. The current analysis, which only considers 20 out of 206 wells, is insufficient and does not use best available information, for example including Public Land Survey System (PLSS) section location data, as was used in the 180/400 Foot Aquifer GSP.

For degraded water quality, the GSP identifies constituents of concern (COCs) within the subbasin. The GSP states (p. 5-30): "*The SVBGSA does not have regulatory authority over groundwater quality and is not charged with improving groundwater quality in the Salinas Valley Groundwater Basin.*" Table 8-4 provides a list of constituents and number of wells that must exceed regulatory standards in order to trigger minimum thresholds but fails to provide justification for how those numbers were selected. The GSP also sets measurable objectives identical to minimum thresholds; the exceedance of minimum thresholds is supposed to trigger additional actions but since minimum thresholds in this plan are identified as measurable objectives, it is unclear what action is triggered. Furthermore, the regulatory standards are not explicitly provided in the GSP.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for chronic lowering of groundwater levels. For the analysis of minimum threshold impact on domestic wells, use best available information such as Public Land Survey System (PLSS) section location data.
- Establish minimum thresholds at the representative monitoring wells that account for the specific undesirable results the GSA would like to avoid.

Degraded Water Quality

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[7]
- Set measurable objectives at lower levels than minimum thresholds (i.e., indicative of better water quality).

[7] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

- Set concentration-based minimum thresholds and measurable objectives for COCs in the subbasin that are impacted by groundwater use and/or management. Ensure they align with drinking water standards[8].
- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts to GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC.

Sustainable management criteria for depletion of interconnected surface water are established by proxy using shallow groundwater elevations observed in 2015 near locations of interconnected surface water. To describe impacts to ecological surface water users, the GSP states (p. 8-50): "*There are no known flow prescriptions on any surface water bodies in the Subbasin. Therefore, the current level of depletion has not violated any ecological flow requirements. This is not meant to imply that depletions do not impact potential species living in or near surface water bodies in the Subbasin. However, any impacts that may be occurring have not risen to the level that triggers regulatory intervention. Therefore, the impacts from current rates of depletion on ecological surface water users is not unreasonable.*" The GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[9] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[10] can be determined.

[8] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[9] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[10] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached[11]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,12].

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[13] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the GSP does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

We acknowledge and commend the inclusion of climate change into key inputs (e.g., precipitation, evapotranspiration, surface water flow, and sea level) of the projected water budget. However, the GSP does not calculate a sustainable yield based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

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[11] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[12] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[13] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent shallow groundwater elevations around DACs, domestic wells, GDEs, and ISWs in the subbasin. The monitoring network that represents water quality conditions around DACs and domestic wells in the subbasin is sufficient in terms of spatial distribution but is insufficient in terms of depth representation.

Figure 7-1 (Eastside Aquifer Monitoring Network for Groundwater Levels) shows that no monitoring wells are located across portions of the subbasin near DACs and domestic wells. The GSP states (p. 7-18): "*There are no data gaps in the ISW monitoring network in the Eastside Subbasin*." However, the GSP states (p. 5-43): "*There is no data that verifies the location and extent of surface water connection to groundwater, nor the extent to which groundwater extraction depletes surface water*." These two sentences appear to directly contradict each other. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[14].

RECOMMENDATIONS

- Provide maps that overlay monitoring well locations with the locations of DACs, domestic wells, GDEs, and ISWs to clearly identify potentially impacted areas. Increase the number of representative monitoring sites (RMSs) in the shallow aquifer across the subbasin for the groundwater elevation and groundwater quality condition indicators. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMSs.
- Provide specific plans to fill data gaps in the monitoring network for GDEs and ISWs. Evaluate how the gathered data will be used to identify and map GDEs and ISWs.
- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

[14] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

- Ensure groundwater elevation and water quality RMSs are tracking groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, GDEs, and ISWs. Groundwater elevation and quality RMS data gaps (spatial and depth) in relation to key beneficial users in the subbasin are provided in Attachment E.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

In Section 9.5.3 (Implementation Action G3: Dry Well Notification System), the GSP states (p. 9-100): "*The GSA could develop or support the development of a program to assist well owners (domestic or state small and local small water systems) whose wells go dry due to declining groundwater elevations.*" The GSP states that the program could involve a notification system, monitoring triggered by lowered groundwater elevations, public outreach, "*...referral to assistance with short-term supply solutions, technical assistance to assess why it went dry, and/or long-term supply solutions*." No further specifics on a drinking water well impact mitigation program are provided, however.

RECOMMENDATIONS

- For DACs and domestic well owners, provide specific plans for implementation of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[15].

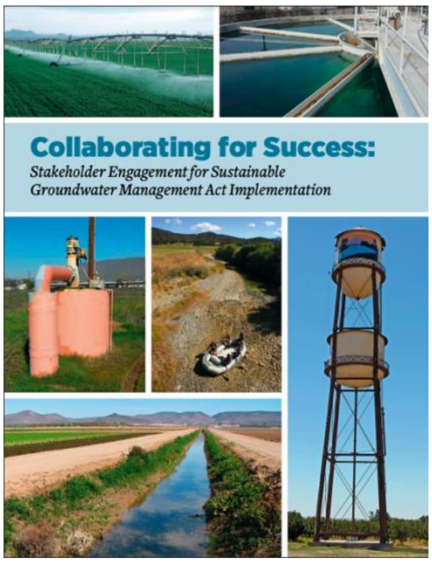
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[15] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



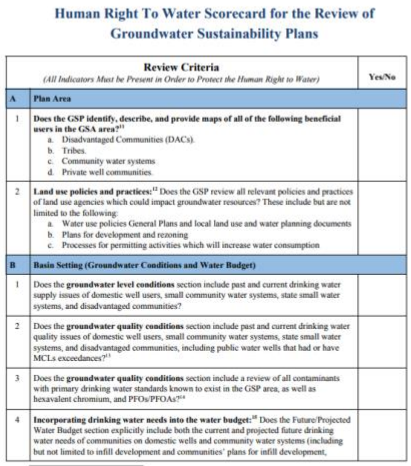
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

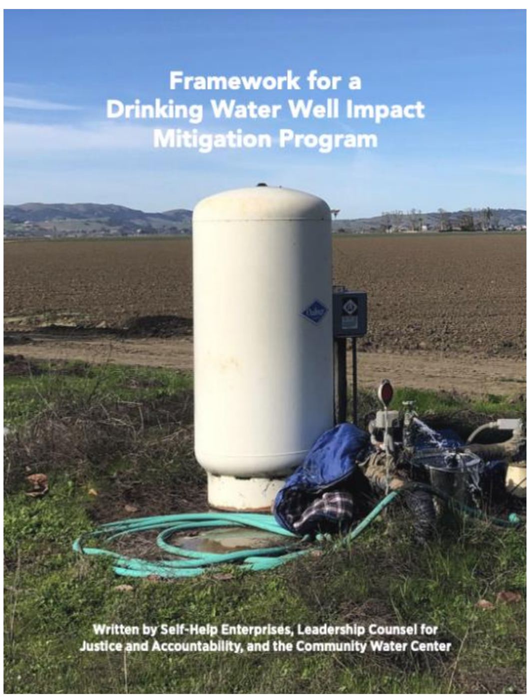
The Human Right to Water


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

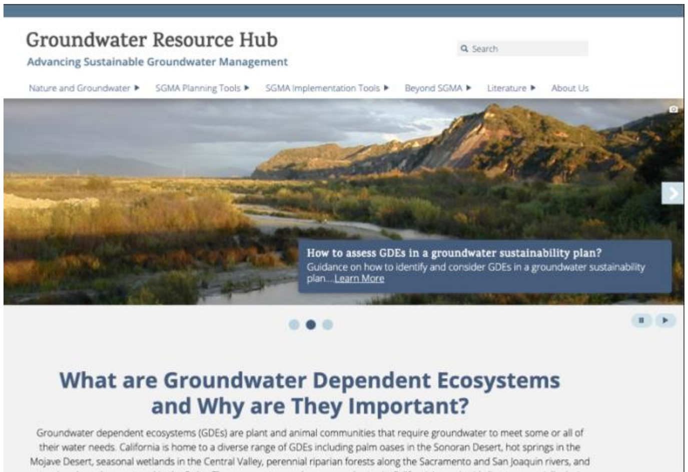
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



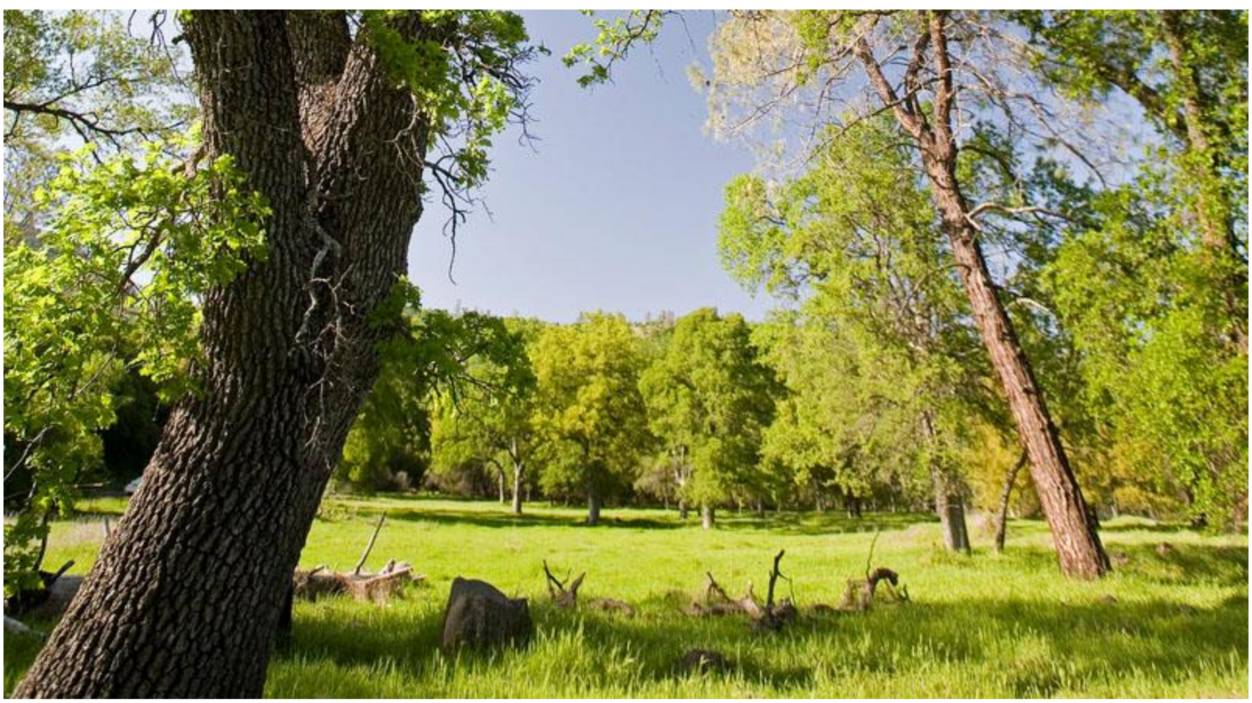
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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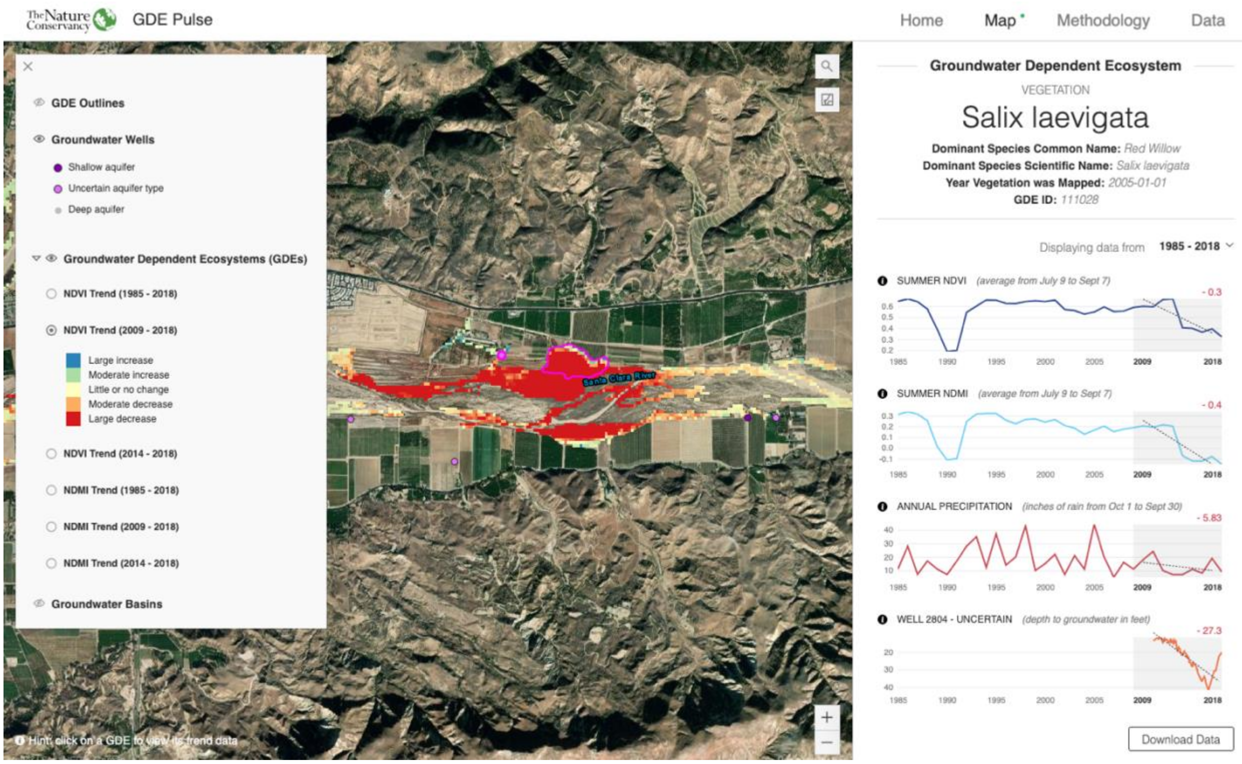
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

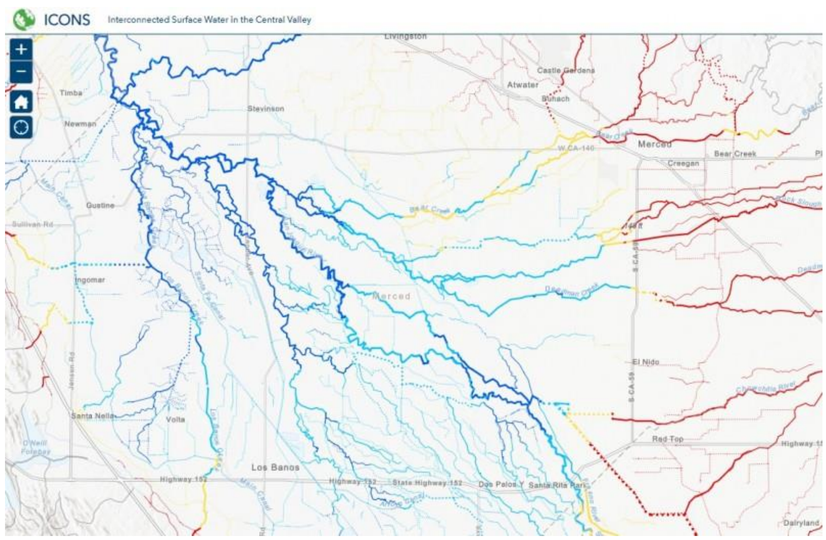
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Eastside Aquifer Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Eastside Aquifer Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	**State**	**Other**
BIRDS				
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Bucephala albeola	Bufflehead			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa solitaria	Solitary Sandpiper			
CRUSTACEANS				

Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
FISH				
Oncorhynchus mykiss - SCCC	South Central California coast steelhead	Threatened	Special Concern	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

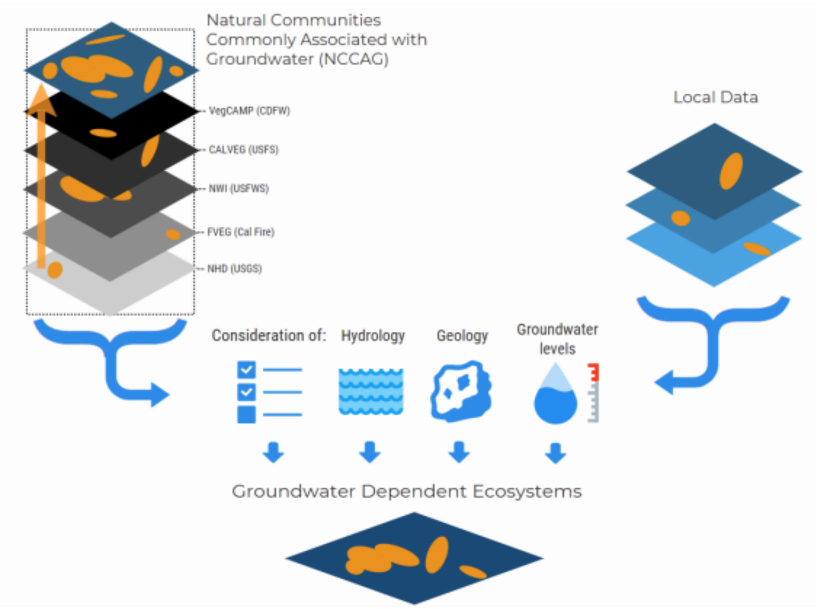


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

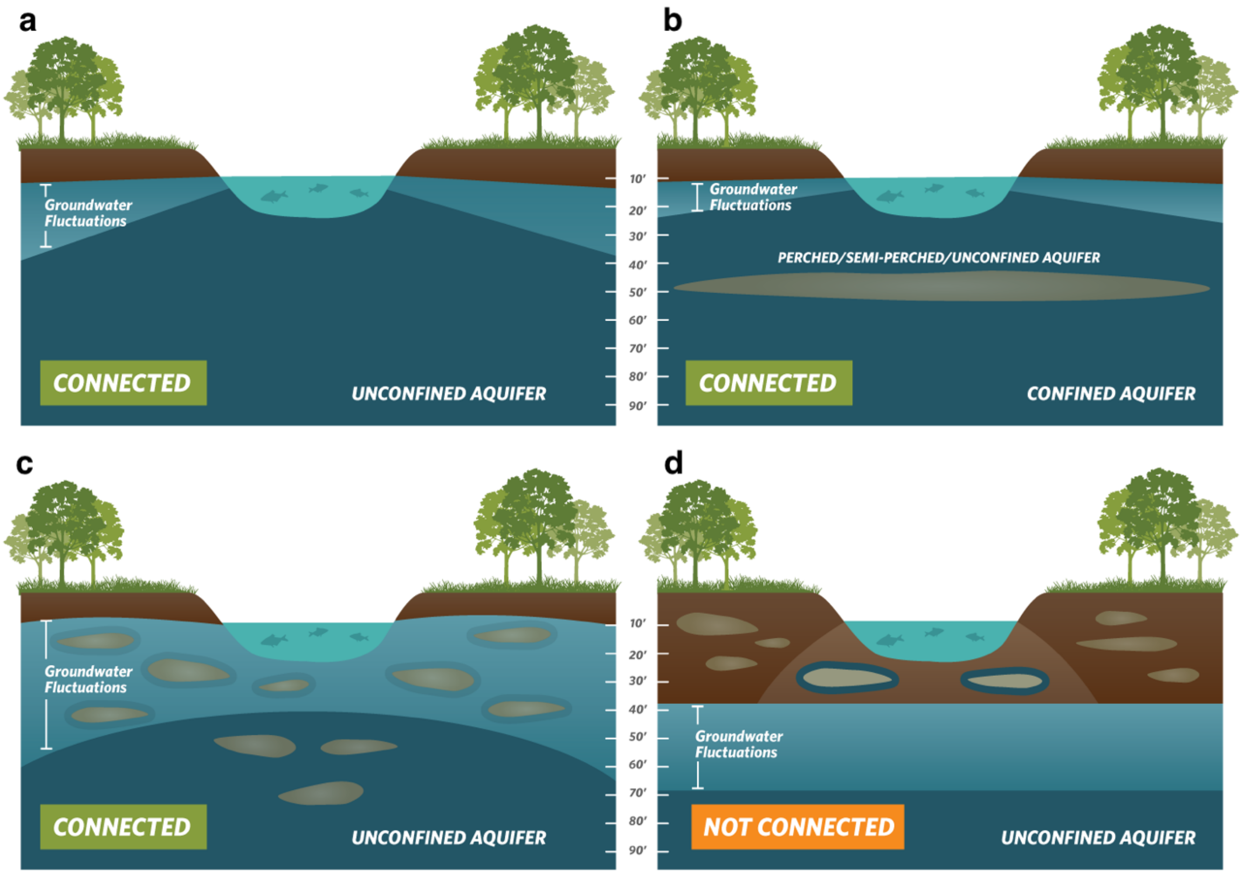

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

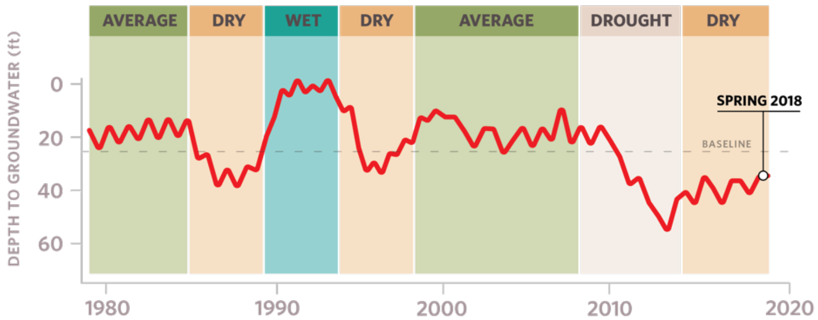

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

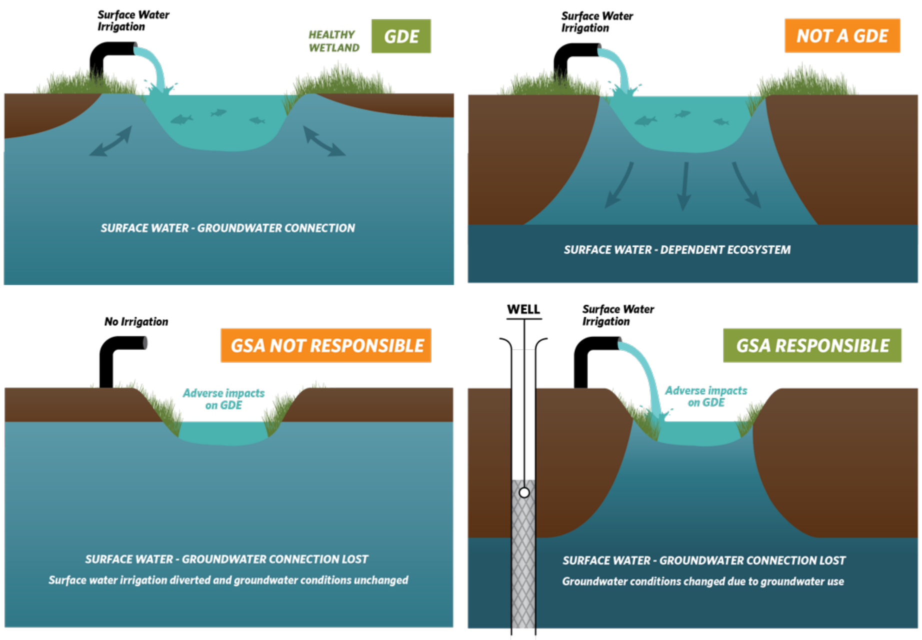

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

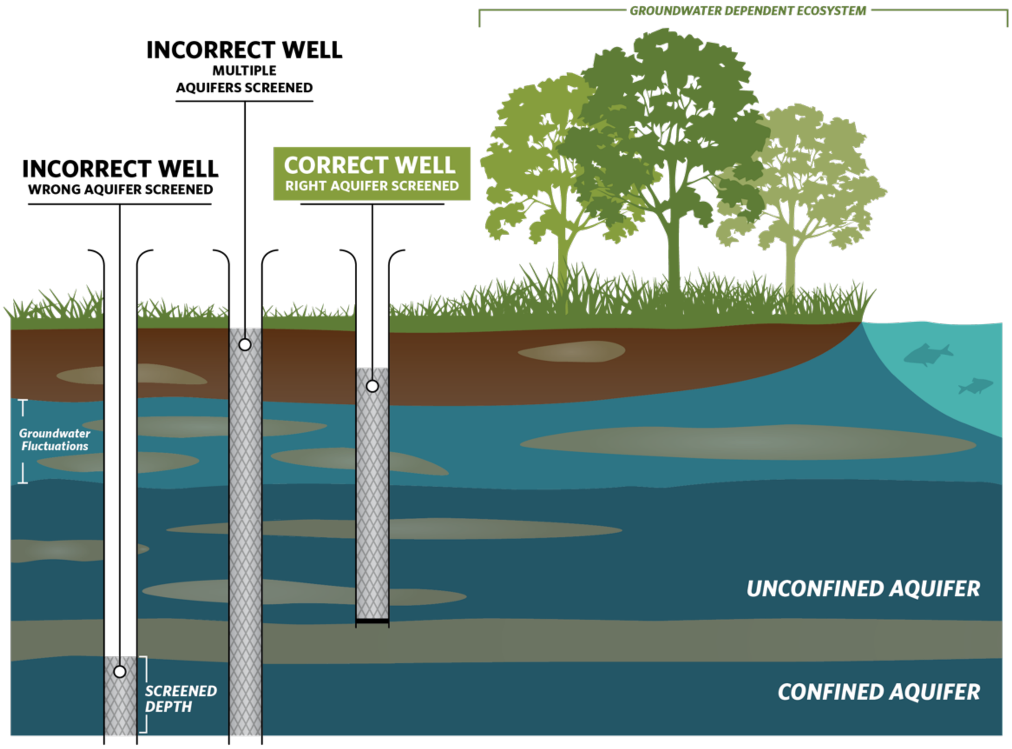

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

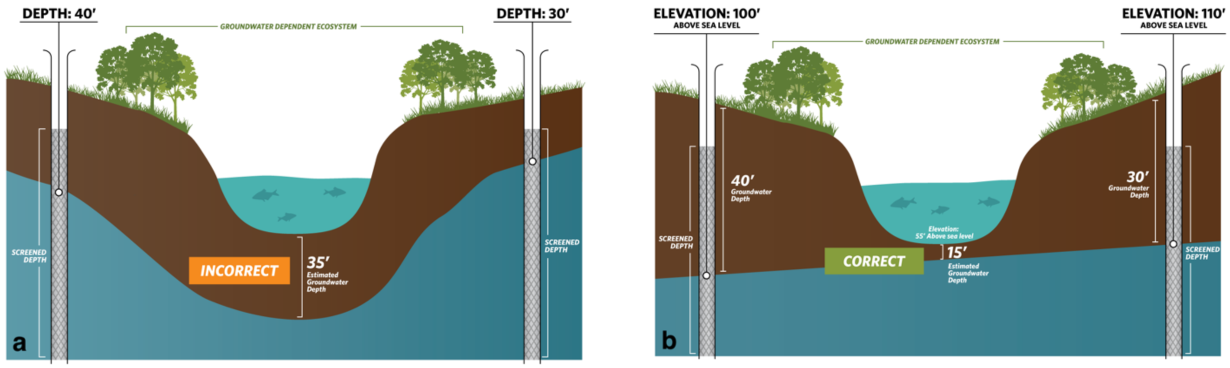

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

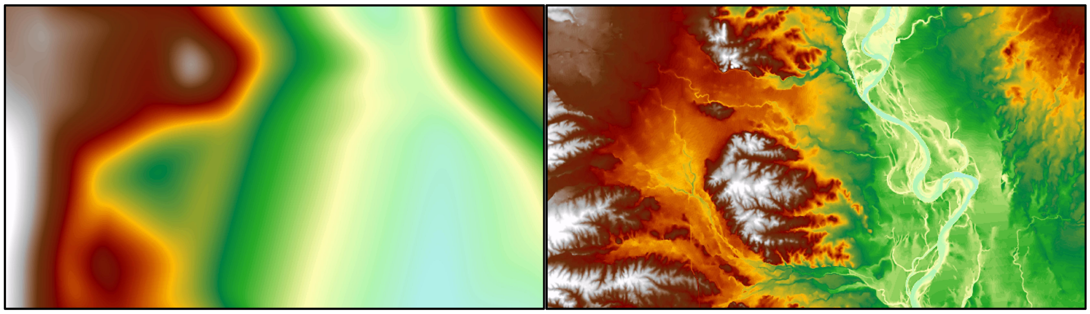

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

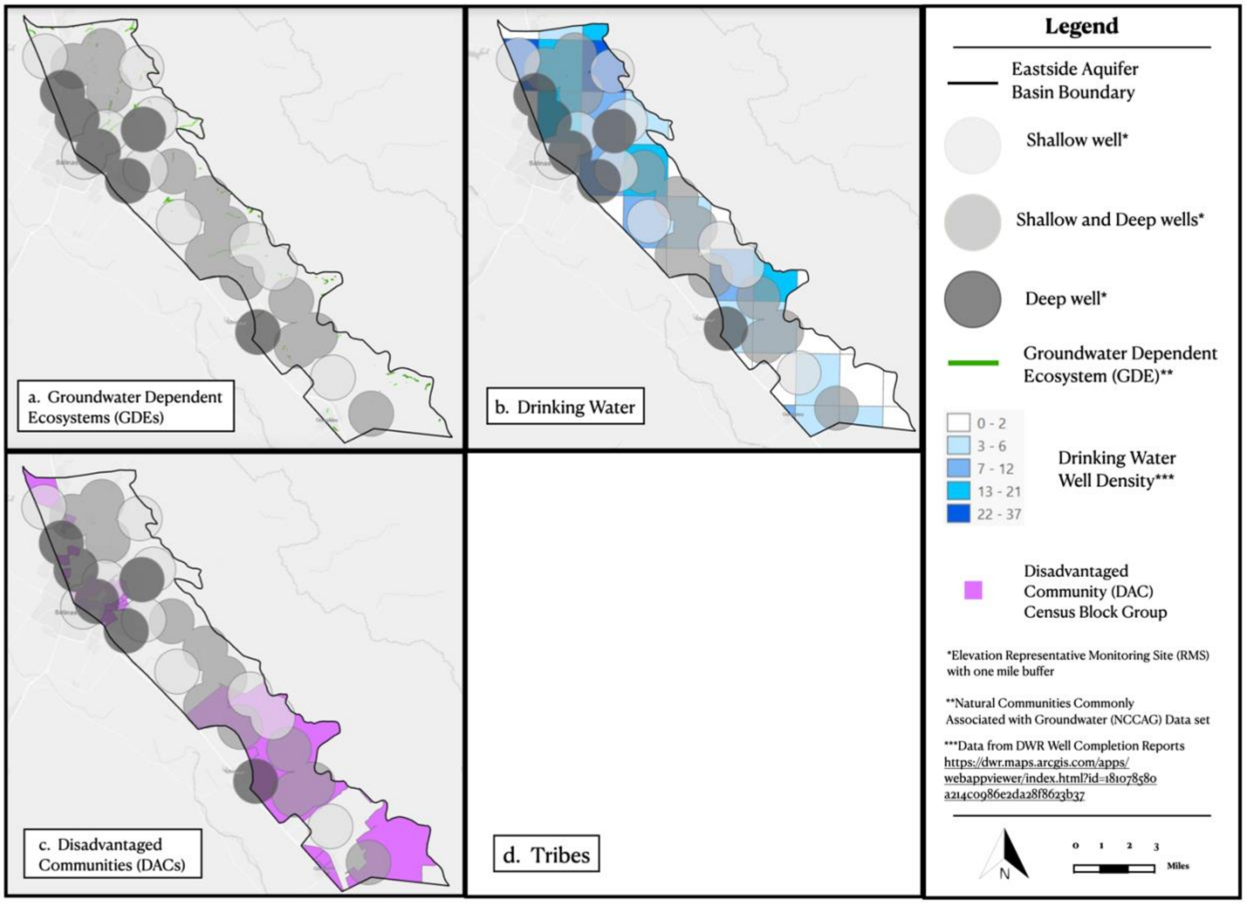

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

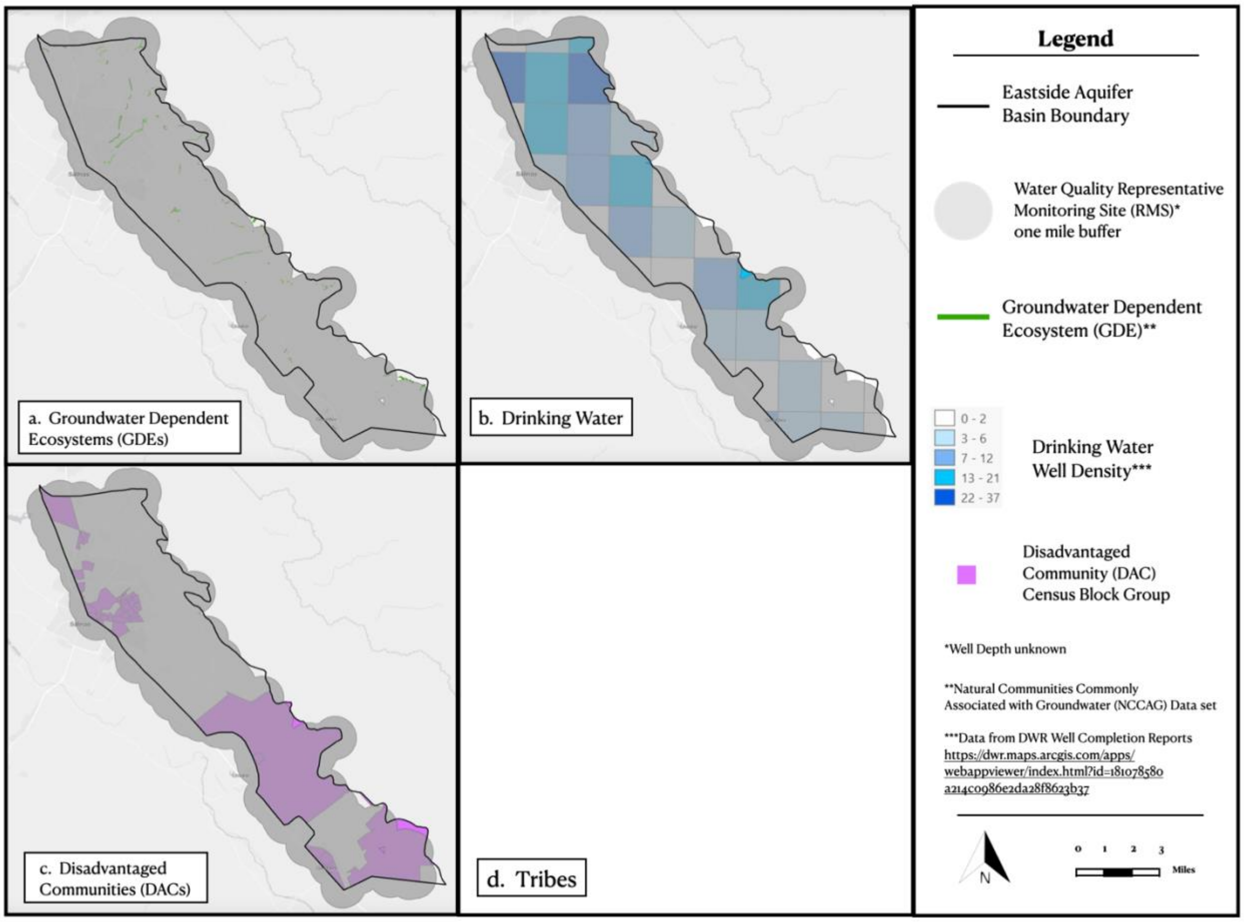

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

December 20, 2021

Humboldt County GSA
c/o Humboldt County Department of Public Works
1106 Second Street
Eureka, CA 95501-0579

Submitted via email: hseemann@co.humboldt.ca.us

Re: Public Comment Letter for Eel River Valley Draft GSP

Dear Hank Seemann,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Eel River Valley Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.

   c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Eel River Valley Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Eel River Valley Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. The GSP identifies and maps the locations of Economically Distressed Areas (EDAs) (Figure 3 of the Stakeholder Engagement Plan) and provides the population of each EDA within the basin. The plan also provides a map of domestic well locations and the depths of these wells within the basin. However, we note the following deficiencies with the identification of these key beneficial users:

- The GSP identifies tribal communities that have cultural and traditional ties within the basin. However, the plan fails to map the locations of tribal lands or tribal interests in the basin.

- The GSP fails to identify the DAC population dependent on groundwater as their source of drinking water in the basin. Specifics should be provided on how much each DAC community relies on a particular water supply (e.g., what percentage is supplied by groundwater).

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide a map of tribal lands for the Bear River Band of the Rohnerville Rancheria and the Wiyot Tribe in the basin. • Provide maps of DACs and SDACs within the basin and clarify if the definition of DACs and EDAs within the basin are the same.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

- Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP primarily uses groundwater elevation data from 2020 and 2021 (both dry years) in the ISW analysis. However, using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs. In California's Mediterranean climate, groundwater interconnections with surface water can vary seasonally and interannually, and that natural variability needs to be considered when identifying ISWs. Furthermore, we recommend that the GSP discuss the screening depths of wells used in ISW analysis to illustrate the connectivity between the shallow principal aquifer and stream reaches in the basin.

We recommend the GSP discuss the gaps in data needed to adequately characterize the interaction between groundwater and surface water within the basin. The GSP should consider any segments with data gaps as potential ISWs and clearly marked as such on maps provided in the GSP.

RECOMMENDATIONS

- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.

- Overlay the basin's stream reaches on depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis and discuss the screening depths of the wells.

- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

- Describe data gaps for the ISW analysis. We recommend that the GSP considers any segments with data gaps as potential ISWs and clearly marks them as such on maps provided in the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **incomplete**. The GSP mapped GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources, including Classification and Assessment with Landsat of Visible Ecology Groupings (CalVeg) data and National Agriculture Imagery Program (NAIP) imagery. However, we found that some mapped vegetation features were improperly disregarded. Vegetation polygons were incorrectly removed in areas with direct precipitation inputs or very local shallow subsurface flows. However, this removal criteria is flawed since GDEs, in addition to groundwater, can rely on multiple water sources simultaneously and at different temporal/spatial scales. Vegetation receiving precipitation inputs or very local shallow subsurface flows can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed from consideration as a GDE solely based on their proximity to these additional water supplies.

We commend the GSA for the comprehensive and detailed description of vegetation communities, critical habitat, and special-status species specific to each GDE subarea in the basin. The GSP could be further improved by confirming that depth-to-groundwater measurements under GDEs are corrected for land surface elevations.

RECOMMENDATIONS

- Re-evaluate the vegetation polygons with direct precipitation inputs or very local shallow subsurface flows. Refer to Attachment C of this letter for best practices for using local groundwater data to verify whether vegetation polygons are supported by groundwater in an aquifer.
- For the depth-to-groundwater contour maps, note the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of native vegetation into the water budget is **insufficient**. The GSP text discusses evapotranspiration from riparian habitats, but it is grouped into a category with all evapotranspiration in the water budget tables. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.
- State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]
[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development
Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Stakeholder Communications and Engagement Plan.[4]

We note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement in general terms for listed stakeholders. Public notice and engagement activities include attendance at Humboldt County GSA Board meetings, Eel River Groundwater Working Group meetings and discussions, direct conversations with Humboldt County GSA Board members and staff, providing written comments to the Humboldt County GSP, and DWR Stakeholder Surveys. The GSP does not state whether there was direct engagement with DACs, tribal stakeholders, or environmental stakeholders.

- The GSP notes that the Eel River Groundwater Working Group is meant to encourage the active involvement of the population during GSP development and implementation and is open for all interested stakeholders. However, the GSP does not include a list of current members.

- The GSP mentions potentially developing a Groundwater Resource Advisory Committee but fails to clearly state if it has already been created or provide a description of its members.

- The plan does not include documentation on how stakeholder input from the above-mentioned outreach and engagement was solicited, considered, and incorporated into the GSP development process.

- Section 9 of the GSP (Implementation), including a section entitled 'Communication and Stakeholder Engagement,' states that the section will be developed for the final plan. As this section of the GSP is finalized, include a detailed plan for continual opportunities for engagement through the implementation phase of the GSP that is specifically directed to DACs, domestic well owners, tribes, and environmental stakeholders within the basin.

RECOMMENDATIONS
• In the Stakeholder Communications and Engagement Plan, describe active and targeted outreach to engage DACs, drinking water users, tribes, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- Provide information on whether the GSA has initiated contact with tribal stakeholders in the basin during GSP development, and how tribal concerns were considered during the GSP development process.

- Provide documentation on how stakeholder input was incorporated into the GSP development process.

- Clearly describe the membership of the Eel River Groundwater Working Group and the Groundwater Resource Advisory Committee.

- Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the basin.[5]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP presents an analysis of the impacts of groundwater levels on wells in the basin. The GSP states (p. 102): *"The total number of wells in the initial well inventory was 221 and included all water supply wells (domestic, agricultural, industrial, public). Of these, wells that had total completed depths of less than 30 feet (14 wells) and/or wells that were constructed prior to 1965 (67 wells) were filtered out to establish the final well dataset for analysis, herein referred to as the 'study wells' (140 total)."* Minimum thresholds were established at groundwater levels at which 10% of the wells within each of two regions would have less than ten feet of water above the bottom of the well. The resulting minimum thresholds are as follows (p. 103): *"For the West Threshold Region, the minimum threshold in each well was set at 13 feet below the average Fall groundwater elevation for that well. For the East Threshold Region, the minimum threshold in each was set at four feet below the average Fall groundwater elevation for that well."* By grouping all water supply wells together, the true impacts to domestic wells have not been determined. Therefore, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users, especially given the absence of a domestic well mitigation plan in the GSP. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, nor does it describe

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[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

how the groundwater level minimum thresholds are consistent with Human Right to Water policy and will avoid significant and unreasonable impacts on these beneficial users.[9]

The GSP states (p. 105): *"An undesirable result would exist if one of the following scenarios occurs: 1. Groundwater levels in four or more representative monitoring sites fall below their minimum thresholds over the course of any one year. 2. Groundwater levels in two or more representative monitoring sites fall below their minimum thresholds for two sequential years."* Using this definition of undesirable results for groundwater levels, significant and unreasonable impacts to beneficial users experienced during single dry years will not result in an undesirable result. This is problematic since the GSP is failing to manage the basin in such a way that strives to minimize significant adverse impacts to beneficial users, which are often felt greatest in below-average, dry, and drought years. Furthermore, the requirement that four monitoring wells exceed the minimum threshold before triggering an undesirable result means that areas with high concentrations of domestic wells may experience impacts significantly greater than the established minimum threshold because the four-well threshold isn't triggered.

For degraded water quality, the GSP only establishes SMC for arsenic. The GSP states (p. 113): *"For this GSP, one constituent of concern, arsenic, was selected as a precautionary measure. The level of concern is the drinking water MCL. The minimum threshold for degraded water quality is set as follows: Two supply wells exceeding the arsenic MCL of 10 ug/L."* According to the state's anti-degradation policy,[10] high water quality should be protected and is only allowed to worsen to the MCL if a finding is made that it is in the best interest of the people of the State of California. No analysis has been done and no such finding has been made. Furthermore, the GSP's Water Quality Technical Memorandum discusses other constituents of concern (COCs), both naturally occurring and those associated with industrial activities. Significantly, nitrate is an acute contaminant which, at levels above the maximum contaminant level, can affect public health. This is a particular concern for domestic wells, as nitrate exceedances do not affect the taste or smell of the water. All COCs in the basin that may be impacted or exacerbated by groundwater use and/or management should be included in the SMC, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels. Include information on the impacts during prolonged periods of below average water years.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users, DACs, and tribes within the basin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be fully or partially de-watered at the minimum threshold.

- Consider minimum threshold exceedances during single dry years when defining the groundwater level undesirable result across the basin.

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3
[10] Anti-degradation Policy https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality.[11] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[12]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.

- Set minimum thresholds and measurable objectives for all water quality constituents within the basin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management.

- Set minimum thresholds that do not allow water quality to degrade to levels at or above the MCL trigger level.

<u>Groundwater Dependent Ecosystems and Interconnected Surface Waters</u>

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the basin, they must be considered when developing SMC for chronic lowering of groundwater levels.

For depletion of interconnected surface water, the GSP describes impacts to fish passage when establishing SMC. The GSP states (p. 116): *"Because fish passage is considered one of the most sensitive indicators of surface water beneficial uses and a quantitative framework for riffle depth is available, the potential change in river stage relative to minimum fish passage depth was selected as the basis for setting minimum thresholds for surface water depletions."* The GSP continues (p. 118): *"A reduction in stage of 0.1 feet was set as a conservative benchmark for potential impact on riffle depth and fish passage. Exceedance of this benchmark does not mean that beneficial uses of the interconnected surface water are degraded or the viability of special-status species are threatened but provides a starting point for analysis. Simulation modeling using a number of conservative assumptions indicated that groundwater pumping could increase by 150% above current conditions before the stage of the Eel River would be reduced by 0.1 feet at the downstream end of the study reach (sub-region ME-7) when fish passage conditions exist."* The GSP also establishes seven wells as representative monitoring sites for monitoring protective water levels associated with potential impacts to interconnected surface waters. We recommend that as the SMC for depletion of interconnected surface water are refined in the future, the GSA further describes what significant and unreasonable effects are for ISWs. We also recommend that the GSP provide discussion that adaptive changes in SMC for ISWs will be made, if groundwater, streamflow, or biological monitoring reveals that existing SMC are not protective of surface water beneficial users.

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[11] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[12] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

RECOMMENDATIONS

- When establishing SMC for the basin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."

- Evaluate impacts on GDEs when establishing SMC for chronic lowering of groundwater levels. When defining undesirable results, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the basin.[13] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[14]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the basin are reached.[15] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[8,16]

- Provide discussion that adaptive changes in SMC for ISWs will be made, if groundwater, streamflow, or biological monitoring reveals that existing SMC are not protective of surface water beneficial users.

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[17] The effects of climate change will intensify the impacts

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[13] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[14] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[15] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[16] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[17] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[18] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the basin. While these extreme scenarios may have a lower likelihood of occurring and their consideration is not required (only suggested) by DWR, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

The GSP fails to clearly illustrate how climate change impacts key inputs (e.g., changes in precipitation, evapotranspiration, and surface water flows) of the projected water budget. While precipitation inputs are stated to be adjusted for climate change in Section 5.7 of the GSP, the plan does not quantify these changes in precipitation in text or in tables for the projected water budget. The plan also fails to provide a sustainable yield for the basin. The sustainable yield should be calculated based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, omission of projected climate change effects on key inputs, and omission of sustainable yield calculated based on the projected water budget with climate change incorporated, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, tribes, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Illustrate how climate change is projected to modify precipitation, evapotranspiration, and surface water flow inputs and include the values in projected water budget tables.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

[18] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around GDEs, tribes, domestic wells, and DACs in the basin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[19]

Figure 39 (Representative Monitoring Sites for Well Impacts) shows sufficient spatial representation for DACs and drinking water users for groundwater elevation monitoring, however depth representation cannot be verified with information provided in the GSP. The GSP does not provide a figure of the water quality monitoring network, therefore we cannot verify the representation of DACs, drinking water users, and tribes for water quality monitoring within the basin.

The GSP does not discuss data gaps for GDEs and ISWs in the Monitoring Network or Project and Management Actions sections of the GSP, despite recognition of sparse groundwater elevation data for some GDE units (e.g., Upper Eel GDE Unit) in the GDE Technical Memorandum. We recommend that the GSP further discuss these data gaps and provide specific plans, such as locations and a timeline, to fill them.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, tribes, and GDEs to clearly identify monitored areas.
- Increase the number of RMSs in the shallow aquifer across the basin as needed to map ISWs and adequately monitor all groundwater condition indicators across the basin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, tribes, GDEs, and ISWs when identifying new RMSs.
- Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, tribes, and GDEs.
- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the basin.

[19] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, tribes, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

We note that the plan does not include a domestic well mitigation program to avoid significant and unreasonable loss of drinking water. We strongly recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[20]

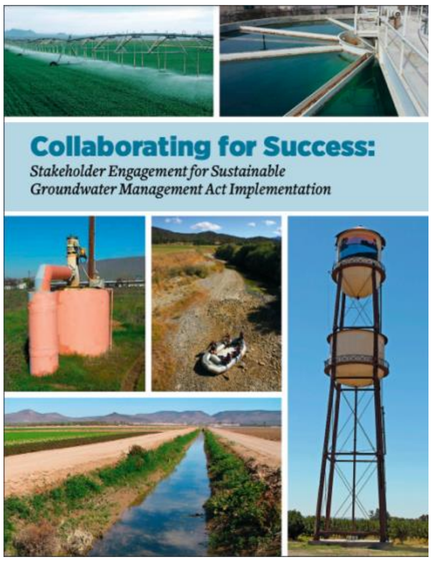
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[20] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



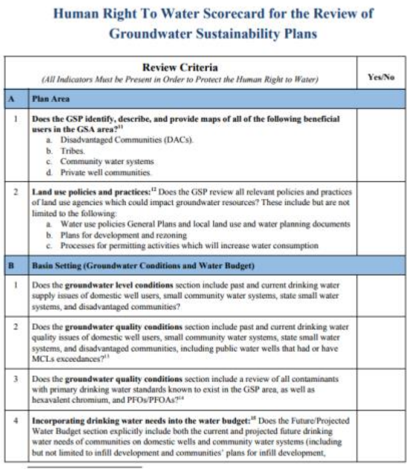
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

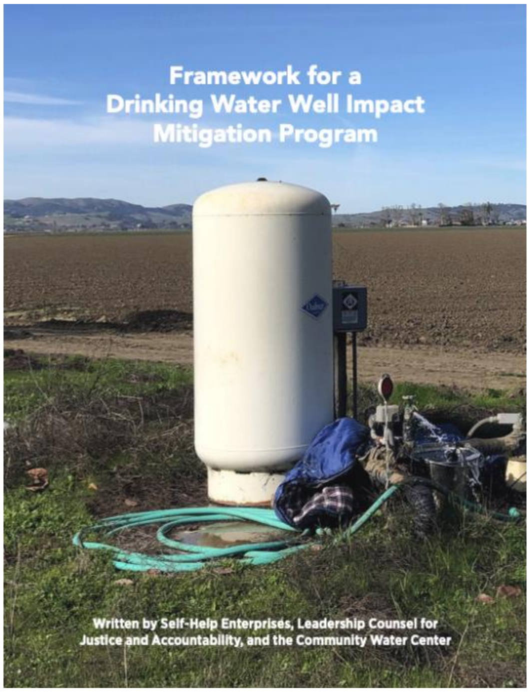


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

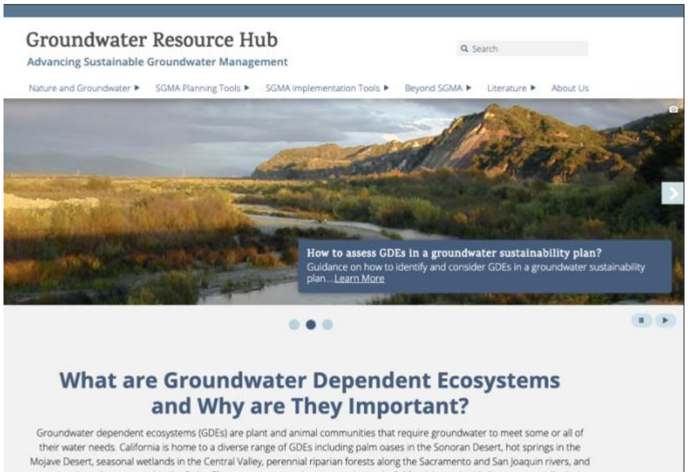
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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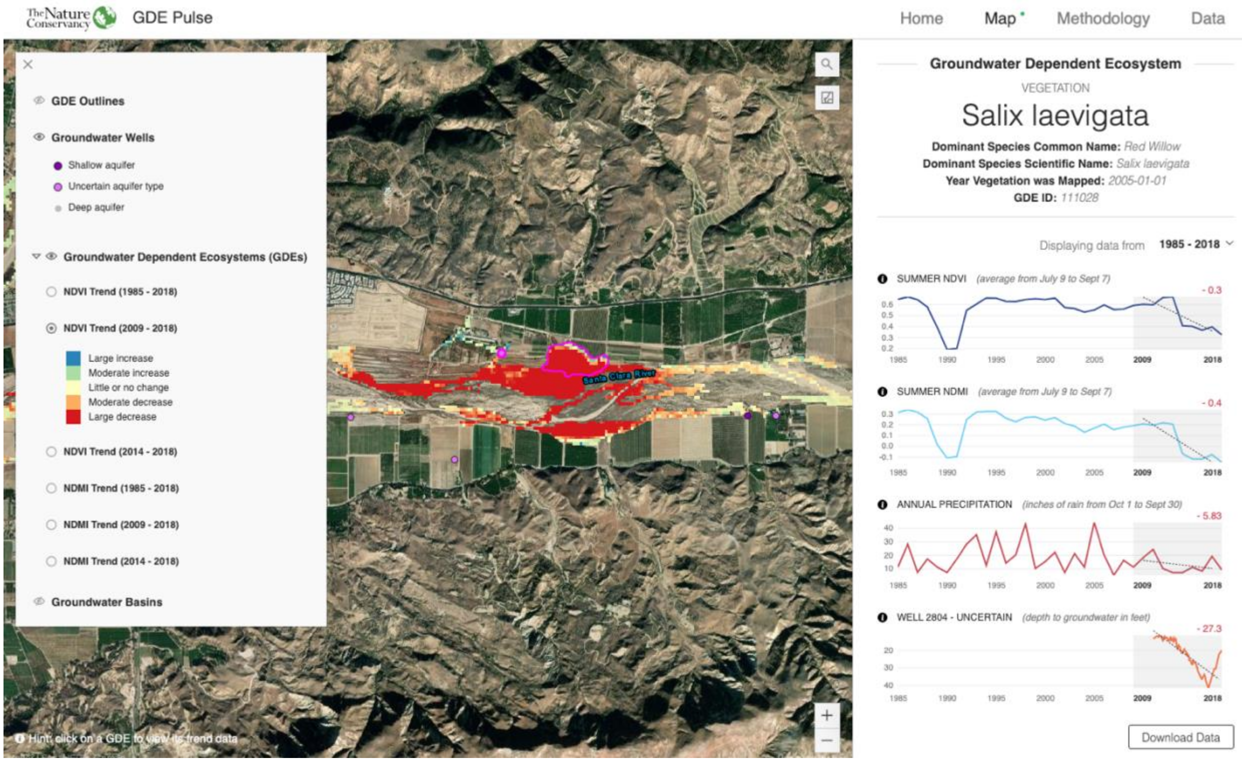
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

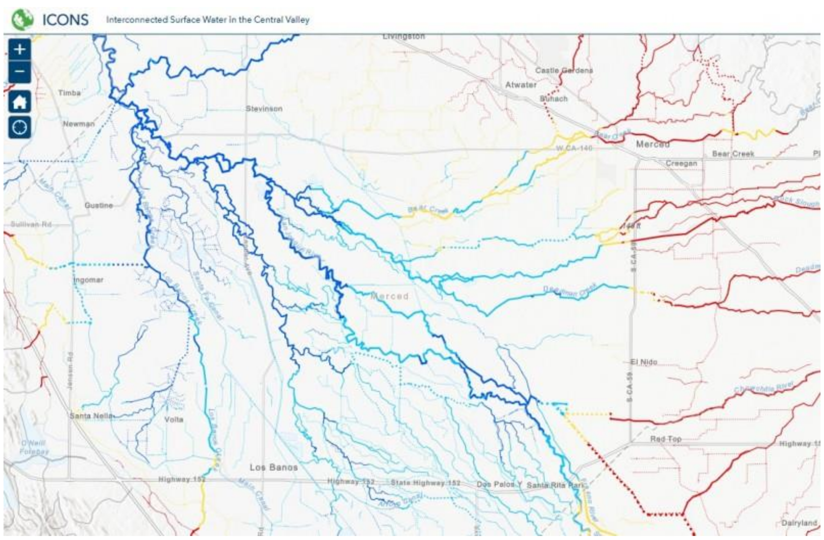
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Eel River Valley Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Eel River Valley Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Candidate - Threatened	Endangered	
Riparia riparia	Bank Swallow		Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cygnus buccinator	Trumpeter Swan			
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			

Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oreothlypis luciae	Lucy's Warbler		Special Concern	BSSC - Third priority
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Americorophium salmonis				Not on any status lists
Americorophium spinicorne				Not on any status lists
FISH				
Eucyclogobius newberryi	Tidewater goby	Endangered	Special Concern	Vulnerable - Moyle 2013
Spirinchus thaleichthys	Longfin smelt	Candidate	Threatened	Vulnerable - Moyle 2013
Oncorhynchus mykiss - NC summer	Northern California coast summer steelhead	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - NC winter	Northern California coast winter steelhead	Threatened		Near-Threatened - Moyle 2013
Oncorhynchus tshawytscha - CCC fall	California Coast fall Chinook salmon	Threatened	Special	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC

Ambystoma gracile	Northwestern Salamander			
Anaxyrus boreas boreas	Boreal Toad			
Ascaphus truei	Coastal Tailed Frog			
Dicamptodon tenebrosus	Pacific Giant Salamander			
Rana aurora	Northern Red-legged Frog		Special Concern	ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rhyacotriton variegatus	Southern Torrent Salamander		Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Thamnophis sirtalis sirtalis	Common Gartersnake			
Dicamptodon ensatus	California Giant Salamander			ARSSC
Thamnophis atratus atratus	Santa Cruz Gartersnake			Not on any status lists
Thamnophis elegans terrestris	Coast Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Amiocentrus aspilus	A Caddisfly			
Anax junius	Common Green Darner			
Antocha monticola				Not on any status lists
Antocha spp.	Antocha spp.			
Archilestes californica	California Spreadwing			
Argia agrioides	California Dancer			
Argia emma	Emma's Dancer			
Argia lugens	Sooty Dancer			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brillia flavifrons				Not on any status lists
Brillia spp.	Brillia spp.			
Calineuria californica	Western Stone			
Centroptilum album	A Mayfly			
Centroptilum spp.	Centroptilum spp.			
Chaetocladius spp.	Chaetocladius spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus anonymus				Not on any status lists
Chironomus spp.	Chironomus spp.			

Cladotanytarsus marki				Not on any status lists
Cladotanytarsus spp.	Cladotanytarsus spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus annulator				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Dicosmoecus gilvipes	A Caddisfly			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Dixidae fam.	Dixidae fam.			
Eukiefferiella claripennis				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Glossosoma alascense	A Caddisfly			
Glossosoma spp.	Glossosoma spp.			
Gomphus kurilis	Pacific Clubtail			
Gumaga griseola	A Bushtailed Caddisfly			
Gumaga spp.	Gumaga spp.			
Hesperoperla pacifica	Golden Stone			
Hetaerina americana	American Rubyspot			
Heterotrissocladius oliveri				Not on any status lists
Heterotrissocladius spp.	Heterotrissocladius spp.			
Hydropsyche alternans				Not on any status lists
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila ajax	A Caddisfly			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Laccobius acutipenis				Not on any status lists
Laccobius spp.	Laccobius spp.			
Lepidostoma spp.	Lepidostoma spp.			
Lestes dryas	Emerald Spreadwing			
Lestes stultus	Black Spreadwing			
Libellula luctuosa	Widow Skimmer			
Libellula saturata	Flame Skimmer			
Macromia magnifica	Western River Cruiser			
Malenka bifurcata				Not on any status lists
Malenka spp.	Malenka spp.			

Micropsectra nigripila				Not on any status lists
Micropsectra spp.	Micropsectra spp.			
Microtendipes caducus				Not on any status lists
Microtendipes spp.	Microtendipes spp.			
Nanocladius anderseni				Not on any status lists
Nanocladius spp.	Nanocladius spp.			
Nemouridae fam.	Nemouridae fam.			
Ophiogomphus bison	Bison Snaketail			
Optioservus canus	Pinnacles Optioservus Riffle Beetle		Special	
Optioservus spp.	Optioservus spp.			
Oreodytes abbreviatus				Not on any status lists
Oreodytes spp.	Oreodytes spp.			
Orthocladius appersoni				Not on any status lists
Orthocladius spp.	Orthocladius spp.			
Paltothemis lineatipes	Red Rock Skimmer			
Paracladopelma alphaeus				Not on any status lists
Paracladopelma spp.	Paracladopelma spp.			
Paratanytarsus grimmii				Not on any status lists
Paratanytarsus spp.	Paratanytarsus spp.			
Pentaneura spp.	Pentaneura spp.			
Phaenopsectra dyari				Not on any status lists
Phaenopsectra spp.	Phaenopsectra spp.			
Polycentropus spp.	Polycentropus spp.			
Polypedilum albicorne				Not on any status lists
Polypedilum spp.	Polypedilum spp.			
Procladius barbatulus				Not on any status lists
Procladius spp.	Procladius spp.			
Progomphus borealis	Gray Sanddragon			
Pseudochironomus richardsoni				Not on any status lists
Pseudochironomus spp.	Pseudochironomus spp.			
Radotanypus spp.	Radotanypus spp.			
Rheotanytarsus hamatus				Not on any status lists
Rheotanytarsus spp.	Rheotanytarsus spp.			

Rhionaeschna californica	California Darner			
Rhyacophila spp.	Rhyacophila spp.			
Sialis arvalis				Not on any status lists
Sialis spp.	Sialis spp.			
Simulium anduzei				Not on any status lists
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sperchon stellata				Not on any status lists
Stictotarsus aequinoctialis				Not on any status lists
Stictotarsus spp.	Stictotarsus spp.			
Sublettea spp.	Sublettea spp.			
Sympetrum corruptum	Variegated Meadowhawk			
Tanytarsus angulatus				Not on any status lists
Tanytarsus spp.	Tanytarsus spp.			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus californicus				Not on any status lists
Tropisternus spp.	Tropisternus spp.			
Tvetenia spp.	Tvetenia spp.			
Tvetenia vitracies				Not on any status lists
Wormaldia anilla	A Caddisfly			
Wormaldia spp.	Wormaldia spp.			
Zaitzevia parvula				Not on any status lists
Zaitzevia spp.	Zaitzevia spp.			
Ameletus majusculus	A Mayfly			
MAMMALS				
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Ferrissia fragilis	Fragile Ancylid			CS
Ferrissia spp.	Ferrissia spp.			
Margaritifera falcata	Western Pearlshell		Special	
Physa acuta	Pewter Physa			Not on any status lists
Physa spp.	Physa spp.			

Pisidium casertanum				Not on any status lists
Pisidium spp.	Pisidium spp.			
PLANTS				
Carex lyngbyei	Lyngbye's Sedge		Special	CRPR - 2B.2
Montia howellii	Howell's Miner's-lettuce		Special	CRPR - 2B.2
Alnus rubra	Red Alder			
Alopecurus saccatus	Pacific Foxtail			
Carex arcta	Northern Clustered Sedge		Special	CRPR - 2B.2
Carex nudata	Torrent Sedge			
Cotula coronopifolia	NA			
Crypsis vaginiflora	NA			
Eryngium aristulatum aristulatum	California Eryngo			
Euthamia occidentalis	Western Fragrant Goldenrod			
Glyceria elata	Tall Mannagrass			
Jaumea carnosa	Fleshy Jaumea			
Populus trichocarpa	NA			Not on any status lists
Ranunculus repens	NA			
Ranunculus sardous	NA			
Salix exigua exigua	Narrowleaf Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Sequoia sempervirens				
Spartina foliosa	California Cordgrass			
Stachys ajugoides	Bugle Hedge-nettle			
Stachys rigida quercetorum				Not on any status lists
Typha latifolia	Broadleaf Cattail			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

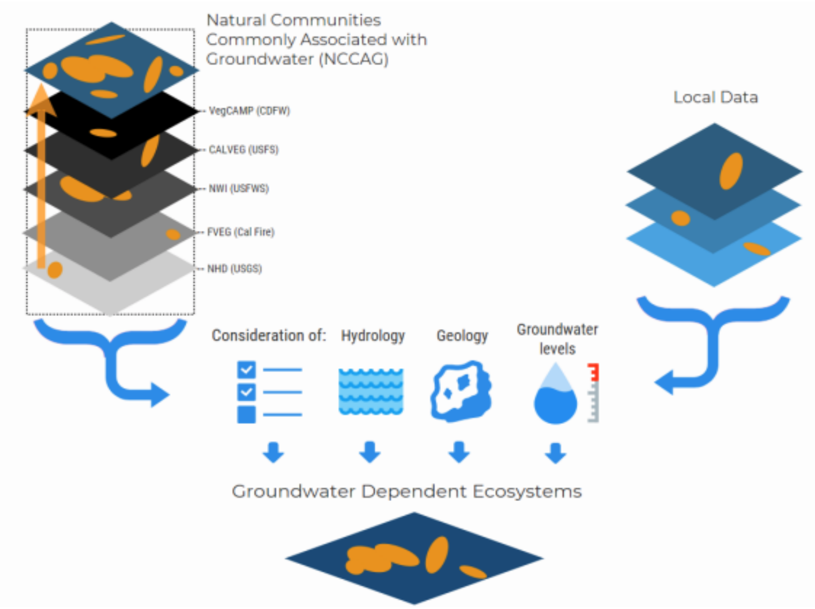


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

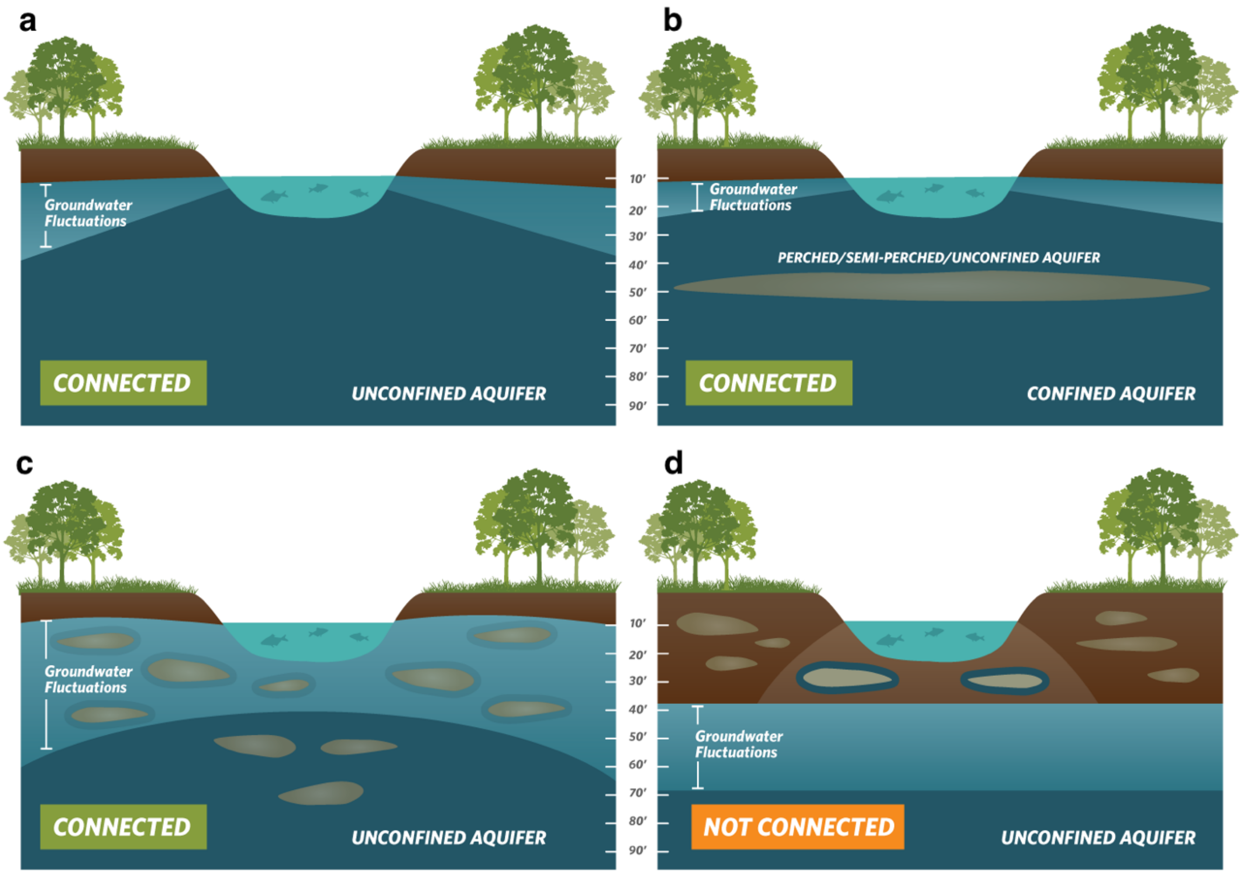

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

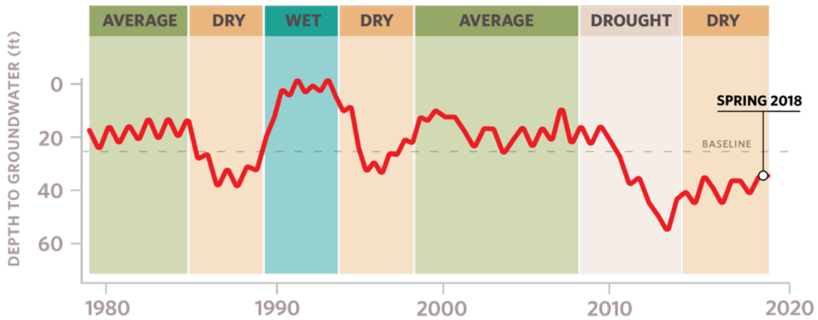

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

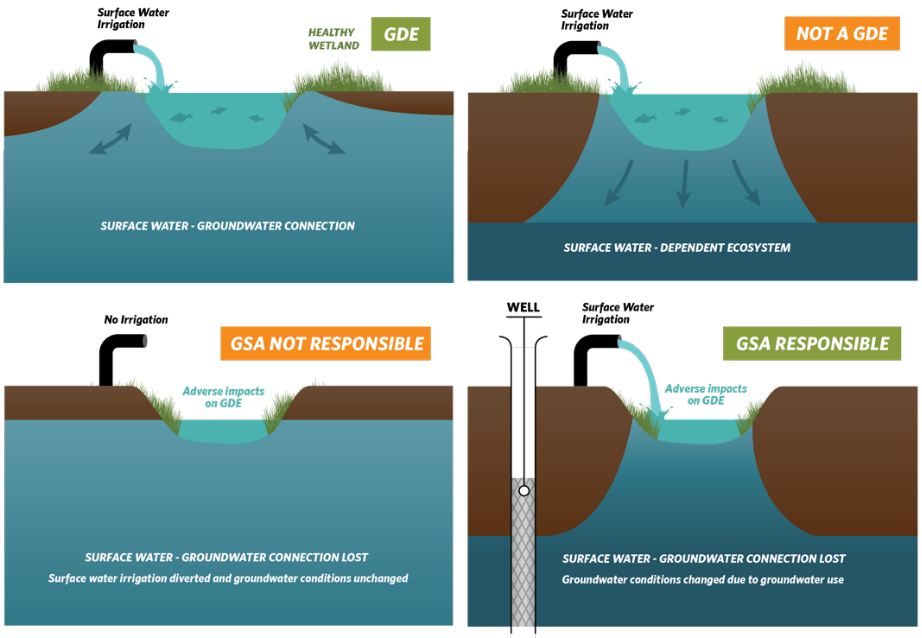

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

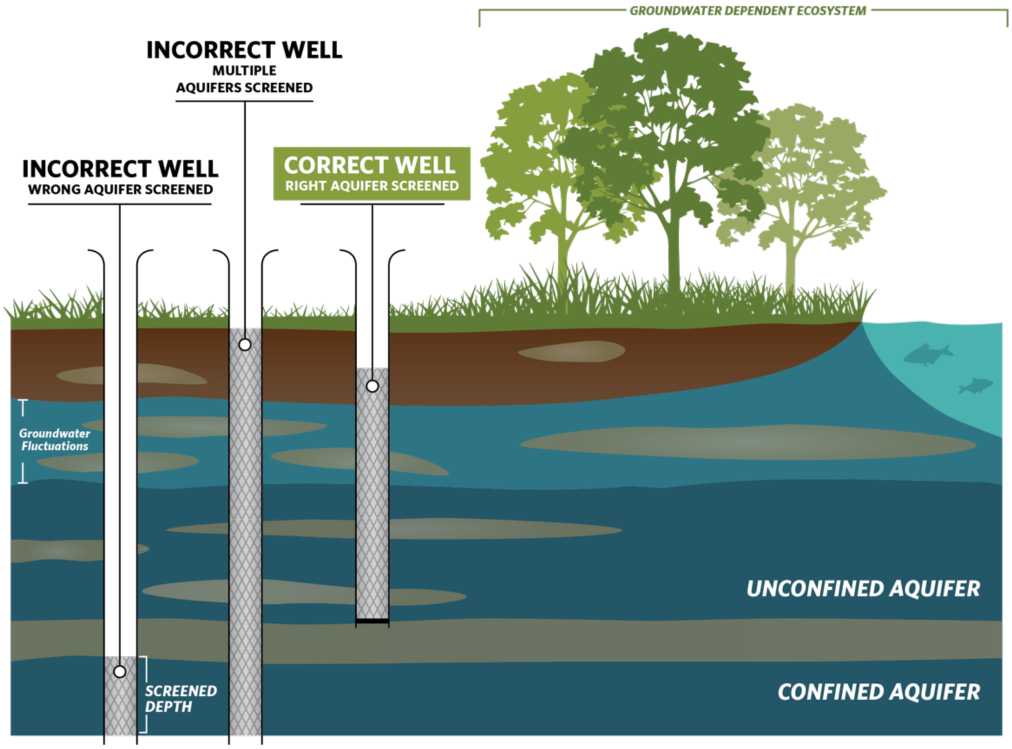

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

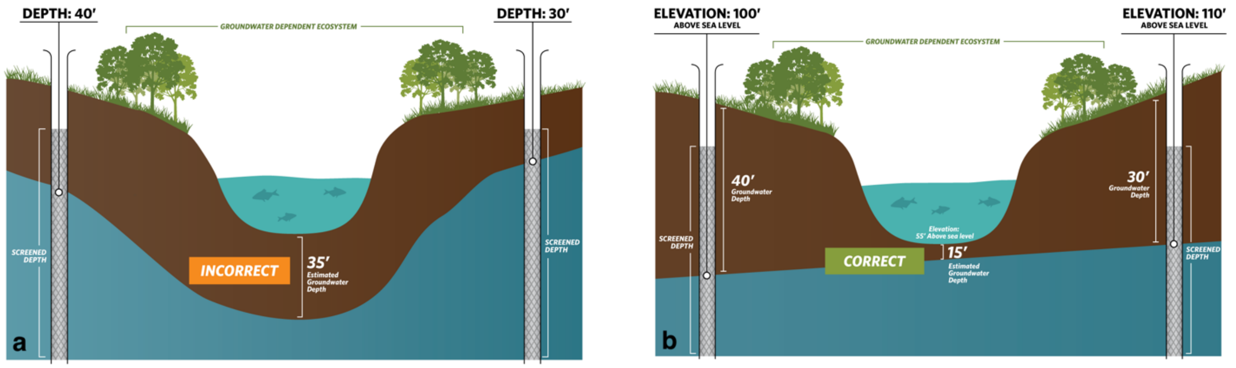

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

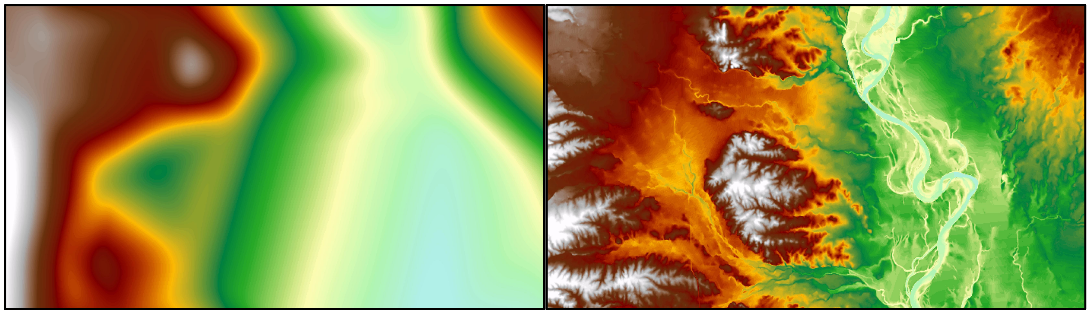

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

October 4, 2021

Elsinore Valley Municipal Water District
P.O. Box 3000
31315 Chaney Street
Lake Elsinore, CA 92531

Submitted via email: jgastelum@evmwd.net

Re: Public Comment Letter for Elsinore Valley Subbasin Draft GSP

Dear Jesus Gastelum,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Elsinore Valley Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Elsinore Valley Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Elsinore Valley Subbasin Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. The GSP fails to identify, map, and describe the population size of DACs that are dependent on groundwater as their source of drinking water in the subbasin. Additionally, tribal lands are not identified and mapped, even though two tribes are mentioned in the Stakeholder Outreach Plan (Appendix C).

The GSP includes a point map of all groundwater wells in the subbasin (Figure 2.7). However, the GSP should be further improved by including domestic wells as a separate category on Figure 2.7 and clearly describing individual domestic well locations and depths.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS
• Provide a map of the DACs in the basin. The DWR DAC mapping tool[1] can be used for this purpose. Include the population of each DAC in the GSP text or on the map. • Describe the occurrence of tribal lands in the subbasin. The GSP does not include any description of tribal lands in the subbasin, but references two tribes (The Soboba and Pechanga Bands of Luiseño Indians) in the Stakeholder Outreach Plan. If the tribes have interests in the subbasin, describe them in detail. • Include a map showing domestic well locations and average well depth across the subbasin. • Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

[1] The DWR DAC mapping tool is available online at: https://gis.water.ca.gov/app/dacs/

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP describes the use of aerial photos to analyze stream reaches during the dry season and presents further analysis of stream gage and groundwater elevation data. The analysis, however, disregards some reaches that may be interconnected in the subbasin.

The GSP states (4-57): "In the Lee Lake Area, wells are monitored at four general locations along the creek (Gregory, Station 70, Barney Lee, and Aberhill), and at all of those locations depth to water is commonly 20 ft or less. Allowing for 10 to 15 ft of elevation difference between the well head and the creek bed, the depths to water are consistent with a plausible interconnection with surface water. However, the lack of perennial flow in that area indicates that groundwater is not discharging into the creek. Hydraulic connection would only occur if and when base flow is present." This section of the GSP appears to discount the time periods when the stream reaches *may* be interconnected. The regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

Figure 4.17 (Surface Water Features) shows gaining and losing reaches in the subbasin, but does not present interconnected and disconnected reaches, including the four regions of possible perennial or seasonal interconnection of groundwater and surface water identified on p. 4-58. Therefore, potential ISWs are not being identified, described, nor managed in the GSP. Until a disconnection can be proven, include all potential ISWs in the GSP. This is necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water.

RECOMMENDATIONS

- Provide a map showing all the stream reaches in the subbasin, with reaches clearly labeled as interconnected or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.
- Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.
- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.
- Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of comprehensive, systematic analysis of the subbasin's GDEs. Furthermore, the GSP discounts the shallow aquifer as a principal aquifer. The GSP states (p. 4-54): "Given the large magnitude of the downward gradients, the shallow aquifer units are for practical purposes perched and unaffected by pumping and water levels in the deep units. This means that Lake Elsinore and nearby wetlands and phreatophytic vegetation are sustained by surface water and not interconnected with the regional groundwater system."

The GSP uses TNC's GDE Pulse Tool to describe trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI), and provided a map of change in NDMI (Figure 4.20) plotted on NC dataset polygons. Additionally, the GSP provides general discussion of riparian vegetation and depth to groundwater. However, the depth to groundwater data was not directly used to verify the NC dataset polygons.

In particular, we found that some mapped features in the NC dataset were improperly disregarded based on the following:

- NC dataset polygons were incorrectly removed based on the presence or proximity of surface water. Wetland polygons were disregarded where vegetation was characterized as seasonally flooded, or where vegetation was assumed to rely on local accumulation of winter and spring rainfall. However, partial reliance on surface water does not necessarily prove that the plants and animals do not access groundwater. Many GDEs often simultaneously rely on multiple sources of water (i.e., both groundwater and surface water), or shift their reliance on different sources on an interannual or inter-seasonal basis.
- NC dataset polygons were incorrectly removed if Normalized Difference Vegetation Index (NDVI) and Normalized Difference Moisture Index (NDMI) data downloaded from GDE Pulse did not correlate with groundwater. This is an incorrect method, since a lack of a relationship does not preclude that groundwater is providing some of the ecosystem's water needs. If the ecosystem is tapping into shallow groundwater then the ecosystem should be categorized as a GDE. If there are no data to characterize groundwater conditions in the shallow principal aquifer, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP.
- NC dataset polygons were incorrectly removed based on the assumption that they are supported by the shallow, perched water table. However, shallow aquifers that have the potential to support well development, support ecosystems, or provide baseflow to streams are principal aquifers, even if the majority of the subbasin's pumping is occurring in deeper principal aquifers. If there are no data to characterize groundwater conditions in the shallow principal aquifer, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP.

RECOMMENDATIONS
• Develop and describe a systematic approach for analyzing the subbasin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained or removed from the NC dataset (and the removal reason if polygons are not considered potential GDEs). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Use depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as “Potential GDEs” in the GSP until data gaps are reconciled in the monitoring network.

- Please provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin and note any threatened or endangered species (see Attachment C in this letter for a list of freshwater species located in the Elsinore Valley Subbasin). The GSP text discusses plant and animal species dependent on groundwater, but does not provide a complete inventory in tabular form.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[2,3] to be included in the water budget. The integration of these ecosystems into the water budget is **insufficient**. The water budget did explicitly include the current, historical, and projected demands of native vegetation, but did not explicitly include the current, historical, and projected demands of managed wetlands. A managed wetland in the Warm Springs area is discussed in Appendix H of the GSP. The omission of explicit water demands for managed wetlands is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including managed wetlands.

[2] “‘Water use sector’ refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation.” [23 CCR §351(al)]

[3] “The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.” [23 CCR §354.18]

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders[4] is not fully met by the description in the Stakeholder Outreach Plan (Appendix C). We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms. They include providing input on sections of the GSP by attending public meetings and reaching out on the GSA website. There is no specific outreach during the GSP development process described for environmental stakeholders, tribal stakeholders, DAC members, and domestic well owners.

- The Stakeholder Outreach Plan does not include a detailed plan for continual opportunities for engagement through the *implementation* phase of the GSP that is specifically directed to environmental stakeholders, tribal stakeholders, DAC members, and domestic well owners.

RECOMMENDATIONS

- Include a more detailed and robust Stakeholder Outreach Plan that describes active and targeted outreach to engage DAC members, domestic well owners, environmental stakeholders, and tribal interests during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the subbasin are required when defining undesirable results[5] and establishing minimum thresholds.[6,7]

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[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

[5] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[6] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[7] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP does not sufficiently analyze direct and indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, or evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

The GSP discounts private domestic wells when establishing SMC, based on the following rationale (p. 6-7): "(1) Accurate information on the location, elevation, status, and construction of private supply wells is not readily available for detailed consideration of the range of adverse effects; (2) during the recent drought, Elsinore Valley Subbasin was not marked by reports of significant water level decline impacts to shallow production wells; (3) responsibility for potential undesirable results to shallow wells is shared between a GSA and a well owner. There is a reasonable expectation that a well owner would construct, maintain, and operate the well to provide its expected yield over the well's life span, including droughts." Therefore, potential impacts on all beneficial users of groundwater in the subbasin have not been considered when defining undesirable results and establishing minimum thresholds.

For degraded water quality, the GSP only includes a very general discussion of impacts to drinking water users when defining undesirable results and evaluating the cumulative or indirect impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss impacts on DACs or tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

The GSP identifies total dissolved solids (TDS), nitrate, and arsenic as the constituents of concern (COCs) in the subbasin. Minimum thresholds for nitrate and TDS are set as follows. The minimum thresholds for nitrate for each management area (MA) is defined as the proposed Basin Plan objective in the Elsinore MA as 5 mg/L and the Basin Plan objective in the Lee Lake and Warm Springs MAs as the Upper Temescal Valley antidegradation goal of 7.9 mg/L. The minimum threshold for TDS for each MA is defined as the proposed Basin Plan Maximum Benefit Objective for the Elsinore MA of 530 mg/L and the Basin Plan Antidegradation Objective for the Lee Lake and Warm Springs MAs of 820 mg/L.

The GSP states (p. 6-26): "The SARWQCB [Santa Ana Regional Water Quality Control Board] currently regulates arsenic within the region but has not currently set standards for arsenic in the Subbasin. At this time, the GSA does not wish to conflict with the management of the SARWQCB by defining a MT or MO that may end up in conflict with their future standards. EVMWD will work closely with SARWQCB and DWR to determine how to manage this parameter in the future." However, SMC should be established for all COCs in the basin, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when defining undesirable results for chronic lowering of groundwater levels.
- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs, drinking water users, and tribes within the subbasin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.

Degraded Water Quality

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[8]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs, drinking water users, and tribes.

- Set minimum thresholds and measurable objectives for arsenic, in coordination with SARWQCB. Ensure they align with drinking water standards[9].

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP only considers GDEs with respect to the depletion of interconnected surface water sustainability indicator, but not the chronic lowering of groundwater levels sustainability indicator. No analysis or discussion is provided in the GSP that describes impacts to GDEs or establishes SMC for GDEs that are directly dependent on groundwater.

The GSP states (p. 6-50): "The MT for depletion of interconnected surface water is the amount of depletion that occurs when the depth to water in areas supporting phreatophytic riparian vegetation of greater than 35 ft for a period exceeding one year. This threshold corresponds approximately to the depth to water beneath the creek channel near water-level monitoring wells during 2014 through 2016." We are concerned that the use of 2014-2016 groundwater elevations as minimum thresholds will not avoid undesirable results to environmental beneficial users. The true impacts to ecosystems under this scenario are not fully discussed in the GSP. If minimum thresholds are set to historic low groundwater levels and the subbasin is allowed to operate at or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse.

The GSP states (p. 6-37): "Undesirable results are considered to commence if water levels along more than half of the reach of Temescal Wash within the Subbasin exceed the MT. By this definition, undesirable results did not occur in the Elsinore Valley Subbasin, because vegetation die-back only occurred along about 0.8 mile of Temescal Wash, or about 9 percent of the total length of the Wash in the Subbasin." The subbasin's ecosystems could be further damaged if groundwater conditions are maintained just above those levels in the long term, since the subbasin would be permitted to sustain extreme dry conditions over multiple seasons and years.

[8] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[9] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

RECOMMENDATIONS

- Define chronic lowering of groundwater SMC directly for environmental beneficial users of groundwater. Describe the direct or indirect impact to GDEs that result from lowered groundwater elevations, since not all of the potential GDEs in the subbasin are adjacent to interconnected surface waters.

- When defining undesirable results for chronic lowering of groundwater levels and depletions of interconnected surface waters, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by groundwater conditions in the subbasin. Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[10] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[11] can be determined.

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[12] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors. However, the GSP does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

We acknowledge and commend the inclusion of climate change into key inputs (e.g., precipitation, evaporation, and surface water flow) of the projected water budget. However, like surface water flow, imported water should be adjusted for climate change for the projected water budget. The sustainable yield is calculated based on the projected pumping with climate change incorporated. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios and projected climate change effects on imported water volumes, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future

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[10] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[11] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[12] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS
• Integrate climate change, including extreme wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions. • Incorporate imported water inputs that are adjusted for climate change to the projected water budget. • Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, GDEs, and ISWs in the subbasin. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[13].

Figure 7.1 (Monitoring Well Network) shows that no monitoring wells are located across portions of the subbasin near DACs and domestic wells. The GSP provides discussion of data gaps for GDEs and ISWs (Sections 6.7.8.1 and Sections 7.7.1.4), however does not provide specific plans, well locations shown on a map, or a timeline to fill the data gaps. Without a map of proposed new monitoring well locations, a determination cannot be made regarding the adequacy of the monitoring network for sustainability indicators moving forward into the GSP implementation phase.

RECOMMENDATIONS
• Provide maps that overlay monitoring well locations with the locations of DACs, domestic wells, GDEs, and ISWs to clearly identify potentially impacted areas. Increase the number of representative monitoring points (RMPs) in the shallow aquifer across the subbasin for all groundwater condition indicators. Prioritize proximity to GDEs, ISWs, DACs, and drinking water users when identifying new RMPs. • Provide specific plans to fill data gaps in the monitoring network. Evaluate how the gathered data will be used to identify and map GDEs and ISWs, and identify DACs and shallow domestic well users that are vulnerable to undesirable results. • Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

[13] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

RECOMMENDATIONS

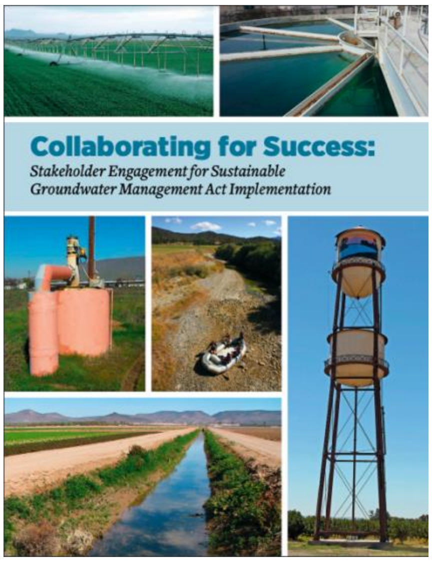
- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.
- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.
- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[14].
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[14] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

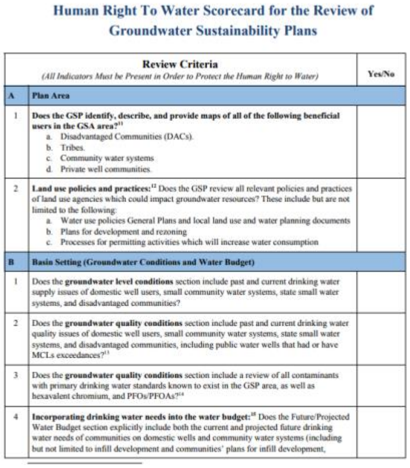
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

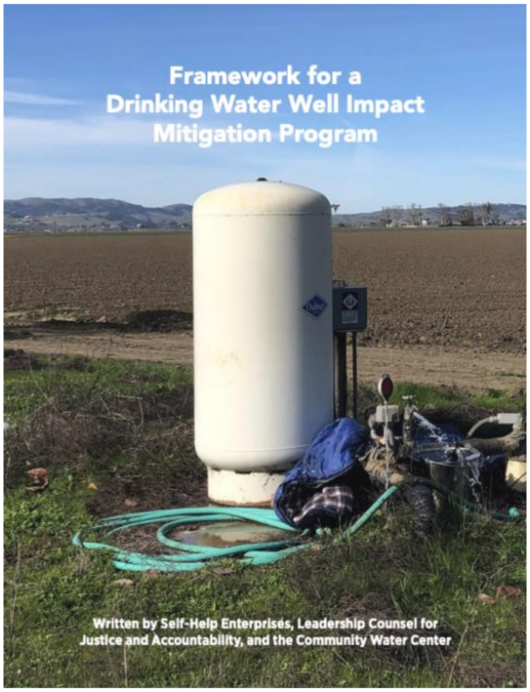
The Human Right to Water


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

Review Criteria (All Indicators Must be Present in Order to Protect the Human Right to Water)		Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

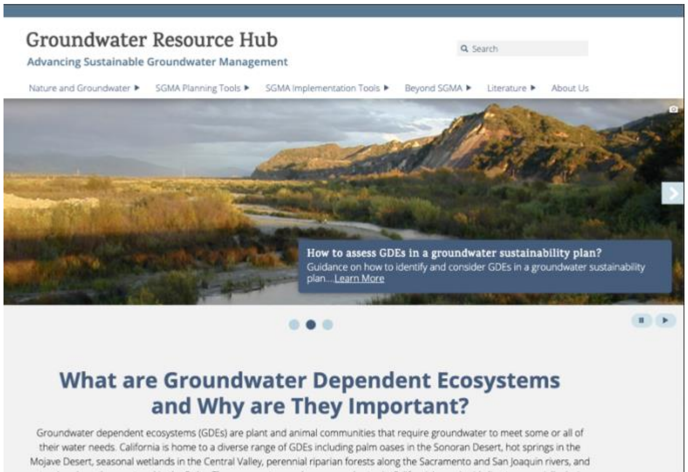
The [Human Right to Water Scorecard](#) was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



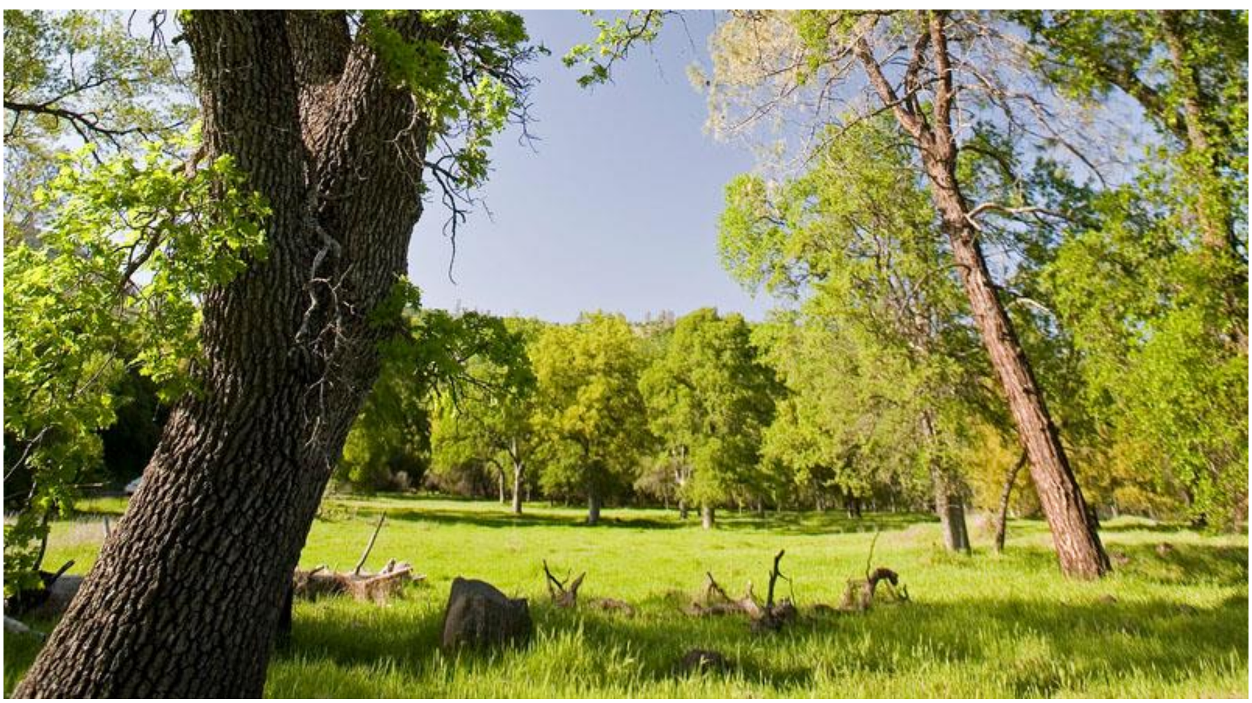
The [Drinking Water Well Impact Mitigation Framework](#) was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

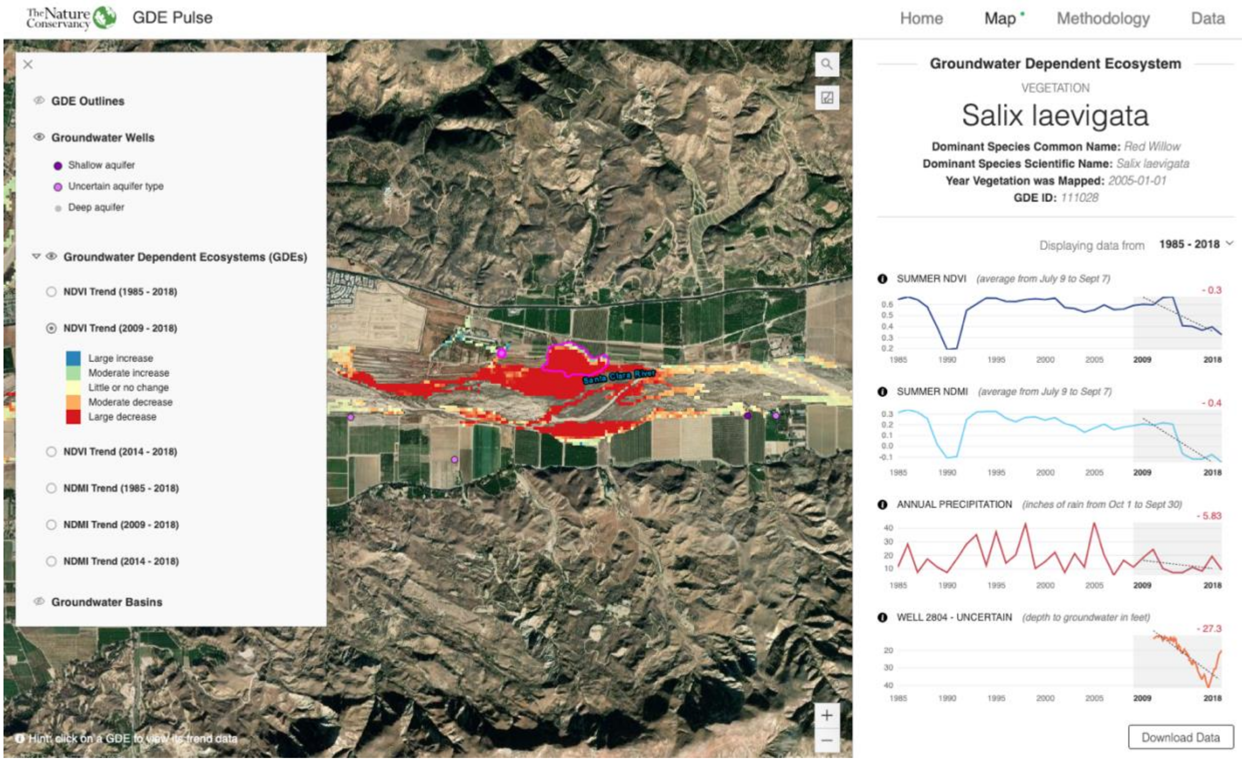
How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

---

[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

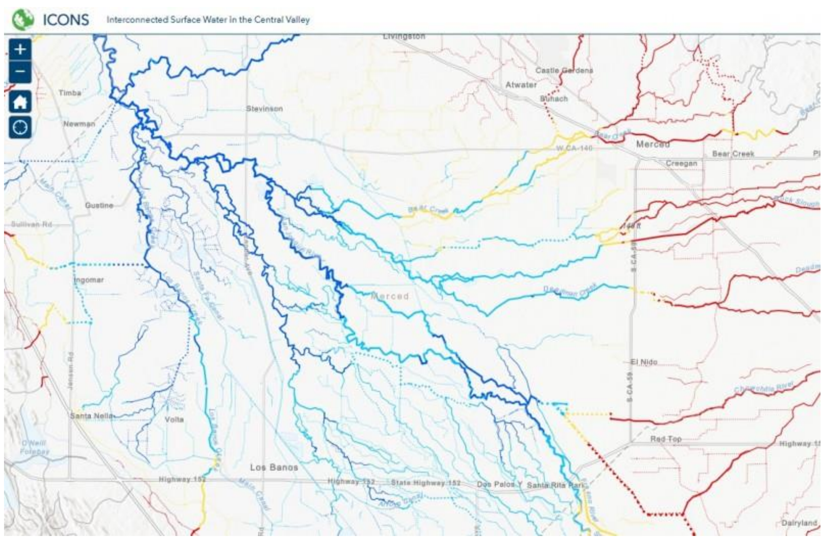
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Elsinore Valley Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Elsinore Valley Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Egretta thula	Snowy Egret			
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Limnodromus scolopaceus	Long-billed Dowitcher			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			

Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
CRUSTACEANS				
Crangonyx spp.	Crangonyx spp.			
Gammarus spp.	Gammarus spp.			
Hyalella spp.	Hyalella spp.			
Streptocephalus woottoni	Riverside Fairy Shrimp	Endangered	Special	IUCN - Endangered
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern	ARSSC
Pseudacris cadaverina	California Treefrog			ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Anaxyrus boreas halophilus	California Toad			ARSSC
INSECTS & OTHER INVERTS				
Argia spp.	Argia spp.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brillia spp.	Brillia spp.			
Caenis spp.	Caenis spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Corisella spp.	Corisella spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus bicinctus				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Enallagma carunculatum	Tule Bluet			

Endotribelos spp.	Endotribelos spp.			
Ephydridae fam.	Ephydridae fam.			
Fallceon quilleri	A Mayfly			
Hydroptilidae fam.	Hydroptilidae fam.			
Limnophyes spp.	Limnophyes spp.			
Micrasema spp.	Micrasema spp.			
Micropsectra spp.	Micropsectra spp.			
Mideopsis spp.	Mideopsis spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Pentaneura spp.	Pentaneura spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Plathemis lydia	Common Whitetail			
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Simuliidae fam.	Simuliidae fam.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Tanypus spp.	Tanypus spp.			
Tanytarsus spp.	Tanytarsus spp.			
Tribelos spp.	Tribelos spp.			
Trichocorixa spp.	Trichocorixa spp.			
Tricorythodes spp.	Tricorythodes spp.			
MOLLUSKS				
Ferrissia spp.	Ferrissia spp.			
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
PLANTS				
Lasthenia glabrata coulteri	Coulter's Goldfields		Special	CRPR - 1B.1
Alnus rhombifolia	White Alder			
Anemopsis californica	Yerba Mansa			
Baccharis salicina				Not on any status lists
Bergia texana	Texas Bergia			
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Castilleja minor minor	Alkali Indian-paintbrush			
Castilleja minor spiralis	Large-flower Annual Indian-paintbrush			
Cotula coronopifolia	NA			

Crassula aquatica	Water Pygmyweed			
Cyperus involucratus	NA			
Elatine brachysperma	Shortseed Waterwort			
Eleocharis macrostachya	Creeping Spikerush			
Epilobium campestre	NA			Not on any status lists
Isolepis cernua	Low Bulrush			
Juncus dubius	Mariposa Rush			
Juncus rugulosus	Wrinkled Rush			
Lemna minor	Lesser Duckweed			
Lythrum californicum	California Loosestrife			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus guttatus	Common Large Monkeyflower			
Mimulus pilosus				Not on any status lists
Myosurus minimus	NA			
Navarretia intertexta	Needleleaf Navarretia			
Orcuttia californica	California Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Phacelia distans	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plagiobothrys undulatus	NA			Not on any status lists
Plantago elongata elongata	Slender Plantain			
Pluchea sericea	Arrow-weed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Rumex salicifolius salicifolius	Willow Dock			
Ruppia cirrhosa	Widgeon-grass			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salvinia minima	NA			Not on any status lists
Schoenoplectus acutus acutus	NA			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus californicus	California Bulrush			
Schoenoplectus saximontanus	Rocky Mountain Bulrush			

Stachys ajugoides	Bugle Hedge-nettle			
Stachys rigida quercetorum				Not on any status lists
Veronica peregrina	NA			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

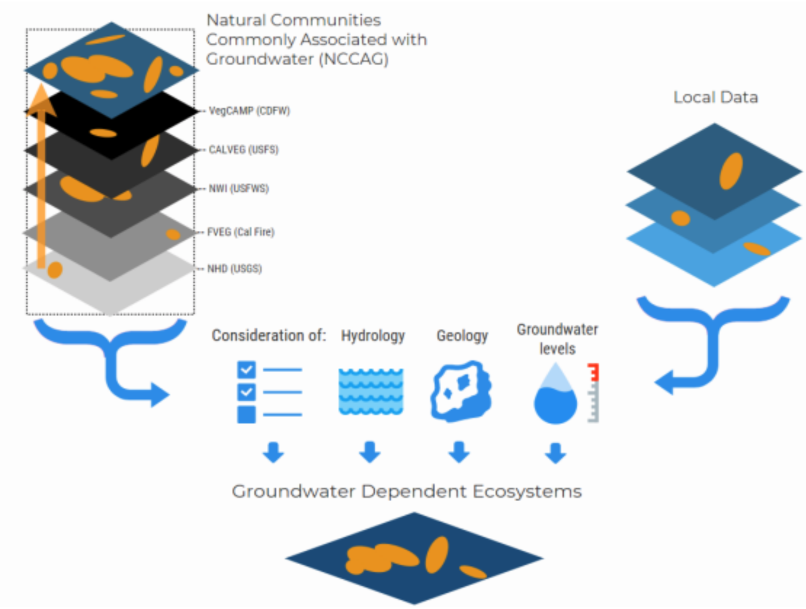


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

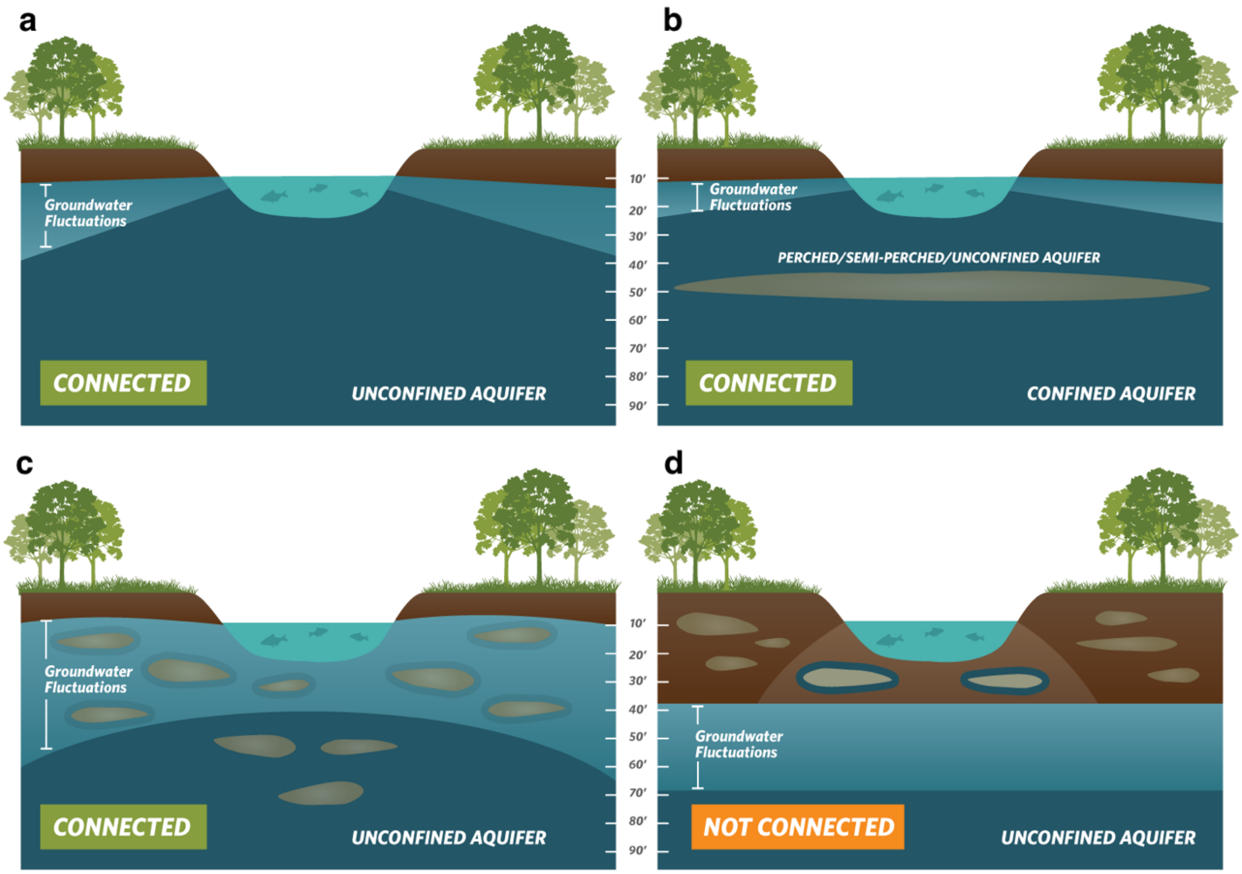

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

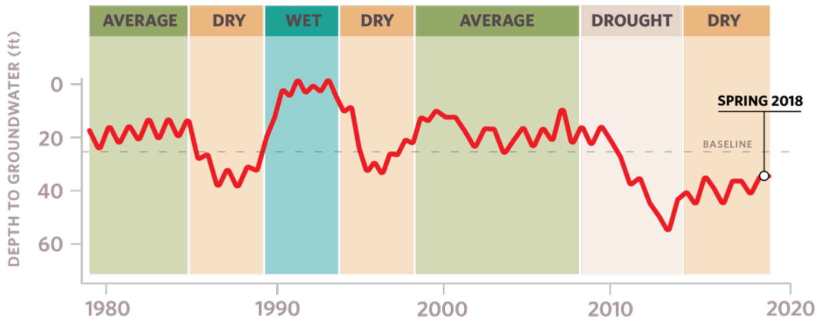

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

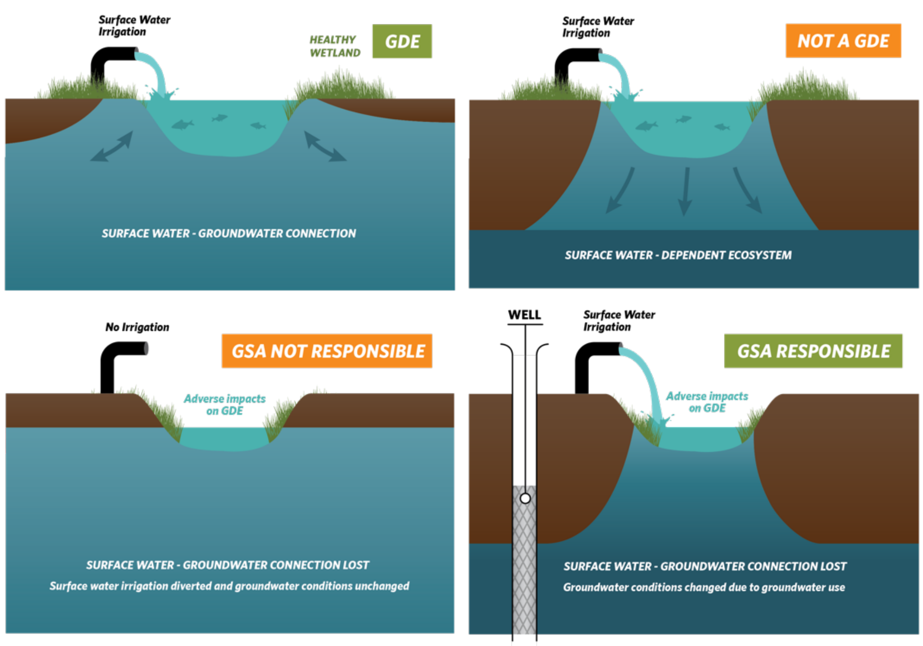

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

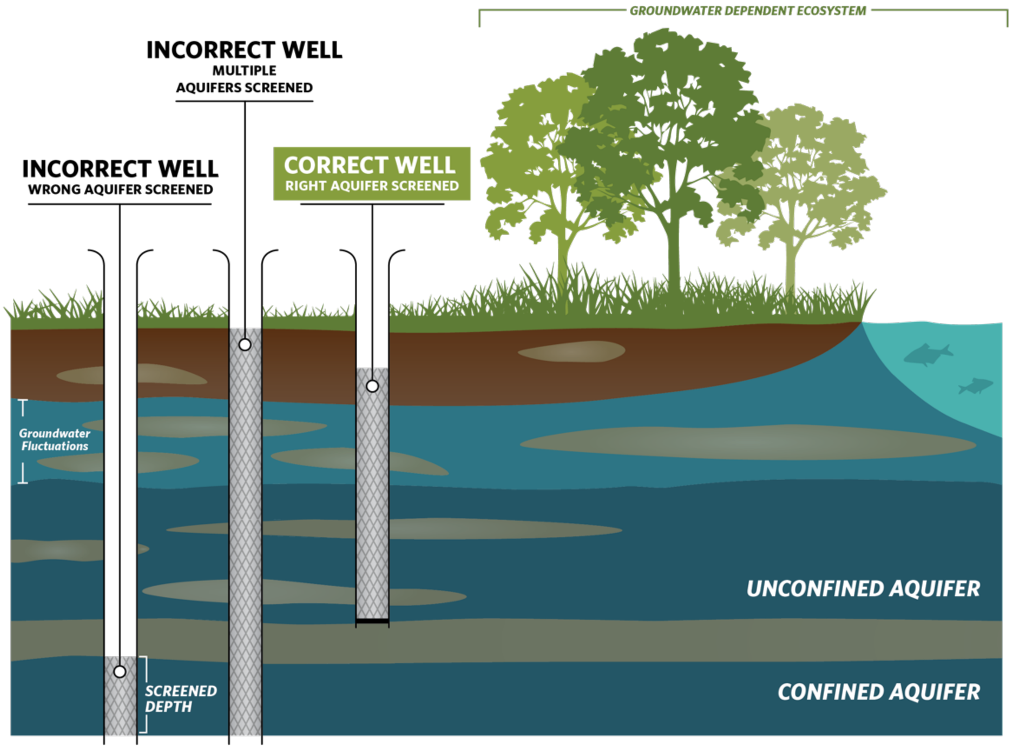

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

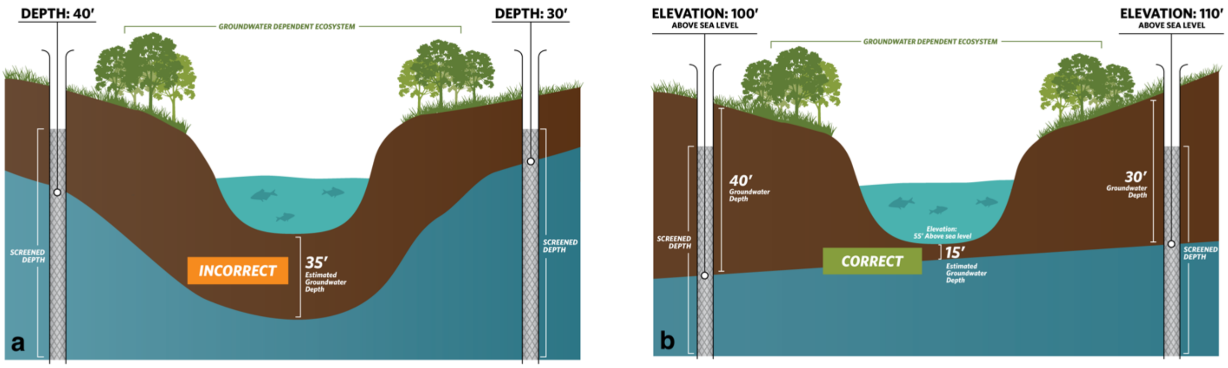

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

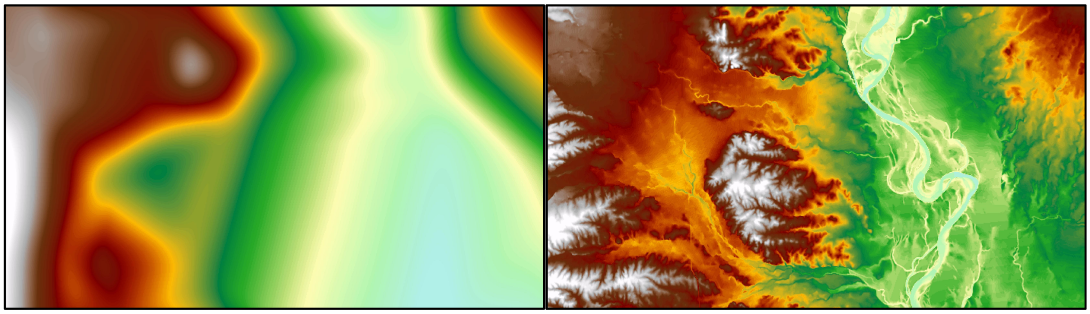

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

November 13, 2021

Enterprise Anderson Groundwater Sustainability Agency

Submitted via email: Lyna.Black@jacobs.com

Re: Public Comment Letter for Enterprise Subbasin Draft GSP

Dear Lyna Black,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Enterprise Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Enterprise Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Enterprise Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP provides information on DACs, including identification by name and location on maps by Census blocks, tracts, and places (Figures 1-2 through 1-4). However, the GSP fails to clearly state the population of each DAC or include the population dependent on groundwater as their source of drinking water in the subbasin.

While the plan provides a density map of domestic wells in the subbasin (Figure 2-6), the GSP fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin. This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the subbasin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide the population of each identified DAC. Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). • Include a map showing domestic well locations and average well depth across the subbasin.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **incomplete**. To assess ISWs in the subbasin, water table elevations as simulated by the EAGSA Model (described in GSP Appendix F) were averaged over 1999-2018 to develop a seasonal high-water-table distribution for the month of April and compared to the stream bottom elevations. This process was utilized to evaluate where modeled streams and the water table were in direct connection. The resulting map of interconnected reaches in the subbasin is presented on Figure 3-17.

The ISW section of the GSP could be further improved by including discussion of data gaps for ISWs. We recommend that the GSP considers any segments with data gaps as potential ISWs and clearly marks them as such on maps provided in the GSP.

RECOMMENDATIONS
● Figure 3-17 showing interconnected reaches could be improved by clarifying the legend labels and colors used for the stream reaches. For example, reaches of the Sacramento River are shown as either a thick blue line or a thin blue line inside a green border. Similarly, reaches of Little Cow Creek are alternating blue and green. It is unclear what the differences are since the text states that the entire lengths of the Sacramento River and LIttle Cow Creek are interconnected. ● Describe data gaps for the ISW analysis. We recommend that the GSP considers any segments with data gaps as potential ISWs and clearly marks them as such on maps provided in the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). Potential GDEs were identified in areas overlying groundwater within 30 feet of land surface based on April 2018 groundwater conditions. Even though the GSP points out that this is conservative because spring represents seasonal high groundwater conditions, we recommend using data from multiple seasons and water year types to determine the range of depth to groundwater around NC dataset polygons. We would like to see additional discussion and use of groundwater data from the pre-SGMA benchmark date of 2015 where available to determine which GDE units are connected to groundwater.

The GSP states that 43 percent of the NC vegetation in the subbasin is Valley Oak. We recommend that an 80-foot depth-to-groundwater threshold be used when inferring whether Valley Oak polygons in the NC dataset are likely reliant on groundwater. This recommendation is based on a recent correction in TNC's rooting depth database,[2] after finding a typo in the max rooting depth units for Valley Oak. This resulted in a specific change in the max rooting depth of Valley Oak from 24 feet to 24 meters (80 feet). For all other phreatophytes, we continue to recommend that a 30-foot depth-to-groundwater threshold be used when inferring whether all other NC dataset polygons are likely reliant on groundwater.

The GSP does not provide an inventory of flora and fauna in the subbasin, except to list the main vegetation types in the subbasin's GDEs. No discussion of threatened or endangered species was provided.

[2] TNC. 2021. Plant Rooting Depth Database. Available at: https://groundwaterresourcehub.org/sgma-tools/gde-rooting-depths-database-for-gdes/

RECOMMENDATIONS

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as Valley Oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether Valley Oak polygons from the NC Dataset are connected to groundwater. It is important to emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

- Discuss data gaps for GDEs. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- Provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin and note any threatened or endangered species (see Attachment C in this letter for a list of freshwater species located in the Enterprise Subbasin).

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[3,4] The integration of native vegetation into the water budget is **insufficient**. The water budget did not include the current, historical, and projected demands of native vegetation. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. The GSP (p. 2-4) states that there are no managed wetlands in the subbasin.

[3] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[4] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

RECOMMENDATION
• Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Communications & Engagement Plan (Appendix C-1).[5]

The GSP notes targeted engagement with environmental stakeholders (The Nature Conservancy and Department of Fish & Wildlife) during the GSP development process via phone calls, email notifications, and targeted briefings and interviews. However, we note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement through outreach materials, soliciting comments and promoting meetings through partnering organizations' newsletters, public workshops, GSA Board meetings, targeted briefings, individual interviews to clarify written comments, and providing the online GSP public comment portal. Specific details of outreach and engagement targeted to DACs include providing Spanish-language versions of outreach materials and announcements, posting flyers in community health centers, engaging with partner organizations such as the Rural Community Assistance Corporation, and training that serves target DAC and Spanish-speaking populations in Redding and Anderson. However, the GSP does not make clear whether DACs are represented on a GSA Advisory Committee or Board, or how their needs and concerns were otherwise considered and incorporated during the GSP development process.

- Aside from the continuation of engagement strategies used during the GSP development process, the GSP does not include a detailed plan for continual opportunities for engagement through the *implementation* phase of the GSP that is specifically directed to DACs, domestic well owners, and environmental stakeholders.

RECOMMENDATIONS
• In the Communications & Engagement Plan, describe active and targeted outreach to engage all stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

[5] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the subbasin within the GSP.[6]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[7,8,9]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP uses a model simulation entitled 'Increased Groundwater Use Scenario' to examine impacts on beneficial users of groundwater. Minimum thresholds are established as follows (p. 6-6): *"The MTs for chronic lowering of groundwater levels were selected as the lower of either the historical minimum measured groundwater elevation or the minimum projected groundwater elevation under the Increased Groundwater Use Scenario at each RMP."*

To examine impacts of minimum thresholds on domestic wells, the GSP states (p. 6-9): *"The MTs for chronic lowering of groundwater levels were compared to the range of public and private well depths in the Enterprise Subbasin to evaluate whether the selected MTs are reasonably protective of these beneficial users."* The GSP continues (p. 6-9): *"The comparison showed that if groundwater levels consistent with those projected in November 2069 under the Increased Groundwater Use Scenario were to occur, then 82 percent of domestic wells in the Enterprise Subbasin would have at least 10 feet of water in them."* However, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold, and whether the undesirable results are consistent with the Human Right to Water policy,[10] especially given the absence of a domestic well mitigation plan in the GSP.

In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs when defining undesirable results, nor does it describe how the groundwater level minimum thresholds are consistent with Human Right to Water policy and will avoid significant and unreasonable impacts on these beneficial users.

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[6] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[7] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[8] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[9] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[10] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

For degraded water quality, minimum thresholds are established for constituents of concern (COCs) as zero additional exceedances of the maximum contaminant level (MCL) or secondary MCL at the representative monitoring points (RMPs). This information suggests that exceedances from other existing sites are acceptable under this GSP. However, any exceedance of MCL or SMCL is a violation of the state's water quality law and is not permitted. Additionally, according to the state's anti-degradation policy,[11] high water quality should be protected and is only allowed to worsen if a finding is made that it is in the best interest of the people of the State of California. No analysis has been done and no such finding has been made.

The GSP sets measurable objectives identical to minimum thresholds. The GSP states (p. 6-22): *"The EAGSA has established the MOs for degraded water quality in the Enterprise Subbasin as the existing distribution of groundwater impairments (i.e., no change from current conditions)."* The exceedance of minimum thresholds is supposed to trigger additional actions but since minimum thresholds are identified as measurable objectives, it is unclear what action is triggered.

Section 3.2.5 of the GSP (Water Quality) and Appendix E (Enterprise Subbasin Groundwater Quality Dataset) present water quality data and discuss trends for several other constituents, including naturally occurring water quality constituents and constituents related to human activity including fuel-related compounds.[12] No SMC have been established for these additional constituents, however. SMC should be established for all COCs in the subbasin impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and drinking water users when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

Degraded Water Quality

- Ensure that the correct water quality appendix is included in the GSP. The GSP text refers to Appendix E as Enterprise Subbasin Groundwater Quality Dataset, but the actual appendix is labeled Anderson Subbasin Groundwater Quality Dataset. It is unclear if just the appendix label is incorrect or if the whole appendix needs to be replaced.

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality.[13] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[14]

[11] Anti-degradation Policy https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf

[12] Note the GSP text refers to Appendix E as Enterprise Subbasin Groundwater Quality Dataset, but the actual Appendix is labeled Anderson Subbasin Groundwater Quality Dataset.

[13] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[14] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users.
- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that are impacted or exacerbated by groundwater use and/or management.
- Set measurable objectives at lower levels than minimum thresholds (i.e., indicative of better water quality).
- Set minimum thresholds that do not allow water quality to degrade to levels at or above the MCL trigger level.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

For chronic lowering of groundwater levels, minimum thresholds are established in the same manner as stated above under Disadvantaged Communities and Drinking Water Users (i.e., established as the lower of two elevations). The same model simulation described above (Increased Groundwater Use Scenario) was used to examine impacts on environmental beneficial users of groundwater.

The GSP states (p. 6-10): *"An assessment of potential effects of the MTs on ecological beneficial users was performed by comparing potential impacts on the extent of GDEs overlying areas of groundwater within 30 feet bgs. Figure 6-5 presents a comparison of the extent of shallow groundwater (depth to water less than or equal to 30 feet bgs) between spring 2018 and a dry month during the projection period under the Increased Groundwater Use Scenario (fall 2069). The latter condition was selected as a conservative estimate of potential depth to water under a multi-year drought and substantially higher than current groundwater pumping within the basin (i.e., a "worst-case" scenario). As shown on Figure 6-5, the lateral extents of groundwater within 30 feet of ground surface in the lower portions of the subbasin where most GDE communities thrive are less in fall 2069 as compared to spring 2018. The total overlying GDE area that was within 30 feet of the water table was approximately 2,170 acres in spring 2018, as compared to approximately 2,050 acres in fall 2069 under the Increased Groundwater Use Scenario. The comparison represents a 5.5 percent reduction in GDE acreage between a relatively wet climatic period and a very dry climatic period under extremely conservative (and unanticipated) groundwater pumping conditions. Therefore, the selected MTs are considered protective of ecological beneficial users."* However, by simply providing the percentage difference in GDE coverage from current conditions to future worst-case conditions, the cumulative impacts to ecosystems under this worst-case scenario are not discussed in the GSP. By assuming that GDEs can be sustained on historic low groundwater levels (or lower) and the subbasin is allowed to operate at or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the adverse impacts (such as widespread tree mortality or loss of critical habitat for aquatic species) can exceed what had occurred prior to 2015.

For depletions of interconnected surface water, the GSP uses groundwater elevations by proxy to establish SMC. The GSP uses the Increased Groundwater Use Scenario model simulation to examine whether significant and unreasonable conditions would likely result due to groundwater pumping under this scenario. The GSP estimates that Sacramento River streamflow would be reduced by 1.2% and Cow Creek Streamflow would be reduced by 8.1% under the Increased Groundwater Use Scenario. The GSP states (6-20): *"Because the estimated depletion of interconnected surface water in the Sacramento River is projected to be within the measurement error of its stream gauge, aquatic species (such as salmon) would not be affected."* However, no conclusions are drawn about Cow Creek streamflow, and whether depletions of interconnected surface water would cause significant and unreasonable conditions. Furthermore, because the GSP does not provide or discuss the aquatic species in the subbasin except for the single mention in the quoted sentence (see Attachment C for a list of environmental users in the subbasin), it has not determined if proposed minimum thresholds avoid significant and unreasonable effects on these surface water beneficial users, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin.[15] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[16]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[17] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,18]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

[15] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[16] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[17] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]
[18] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[19] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[20] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using RCP 8.5 and the HadGEM2-ES Global Climate Model. However, the GSP does not consider other extreme climate scenarios in the projected water budget. We encourage you to consider other GCM projections. While HadGEM2-ES may better represent median conditions, other models may better capture other statistics relevant for your subbasin and may reveal valuable information to account for uncertainty. In addition, the GSP should clearly and transparently incorporate extremely wet and dry scenarios or select more appropriate extreme scenarios for their subbasin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP integrates climate change into key inputs (e.g., changes in precipitation and evapotranspiration) of the projected water budget. However, it is unclear whether imported water is included in the surface water inputs that were adjusted for climate change. The sustainable yield is calculated based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of extreme climate scenarios and the omission of projected climate change effects on imported water flow inputs, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Consider other GCM projections to account for uncertainty beyond median statistics.
- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change into surface water flow inputs, including imported water, for the projected water budget.
- Incorporate climate change scenarios into projects and management actions.

[19] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]
[20] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, GDEs, and ISWs in the subbasin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[21]

Figure 5-1 (Groundwater Level Monitoring Network) shows insufficient representation of DACs and drinking water users for groundwater elevation monitoring. Figure 5-2 (Groundwater Quality Well Network) shows insufficient representation of DACs and drinking water users for water quality monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater.

The GSP provides some discussion of data gaps for GDEs in Section 8.3.1 (Groundwater Level Data Gaps), but does not provide specific plans, such as locations or a timeline, to fill the data gaps.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify monitored areas.
- Increase the number of RMPs in the shallow aquifer across the subbasin as needed to map ISWs and adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMPs.
- Ensure groundwater elevation and water quality RMPs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.
- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient** due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

[21] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

While the GSP (Section 7.1.3) describes the environmental benefits of Storm Water Resources Plans, the GSP fails to describe this or other project's explicit benefits or impacts to other beneficial users, such as DACs. The GSP also fails to include a domestic well mitigation program to avoid significant and unreasonable loss of drinking water.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[22]

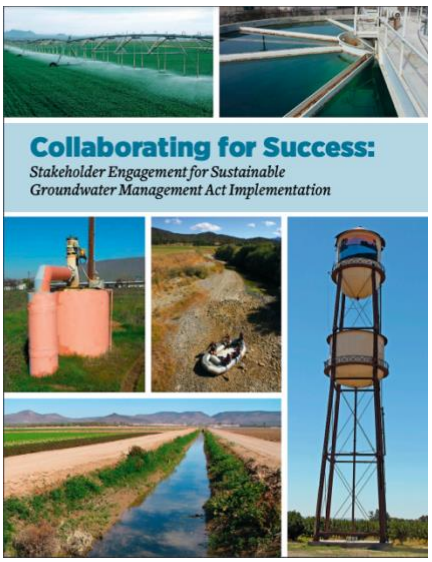
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[22] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

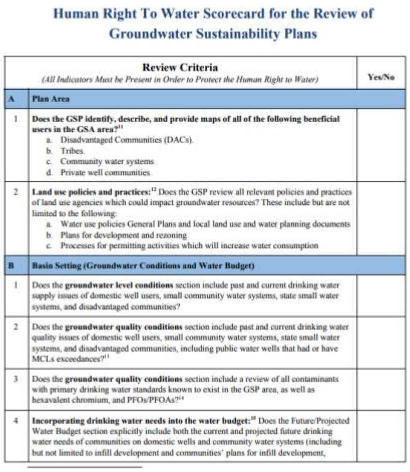
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

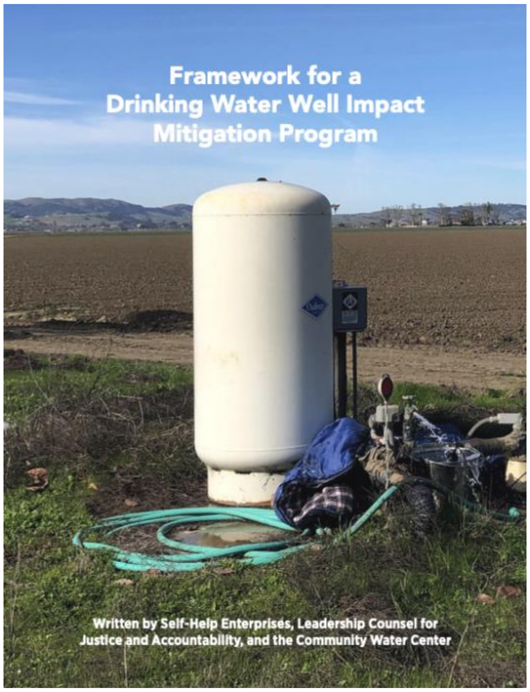
The Human Right to Water


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

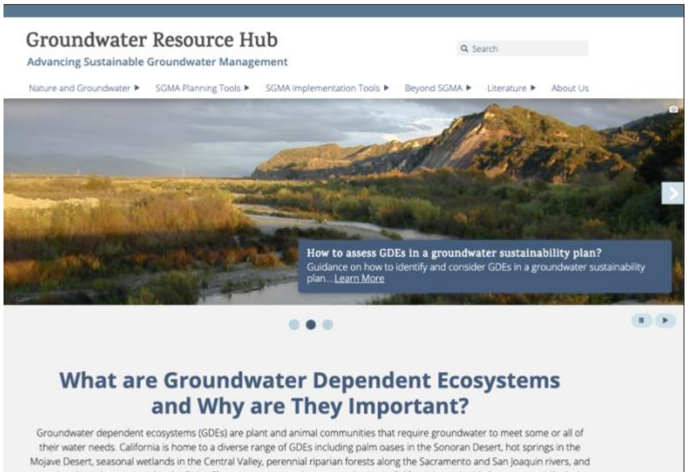
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



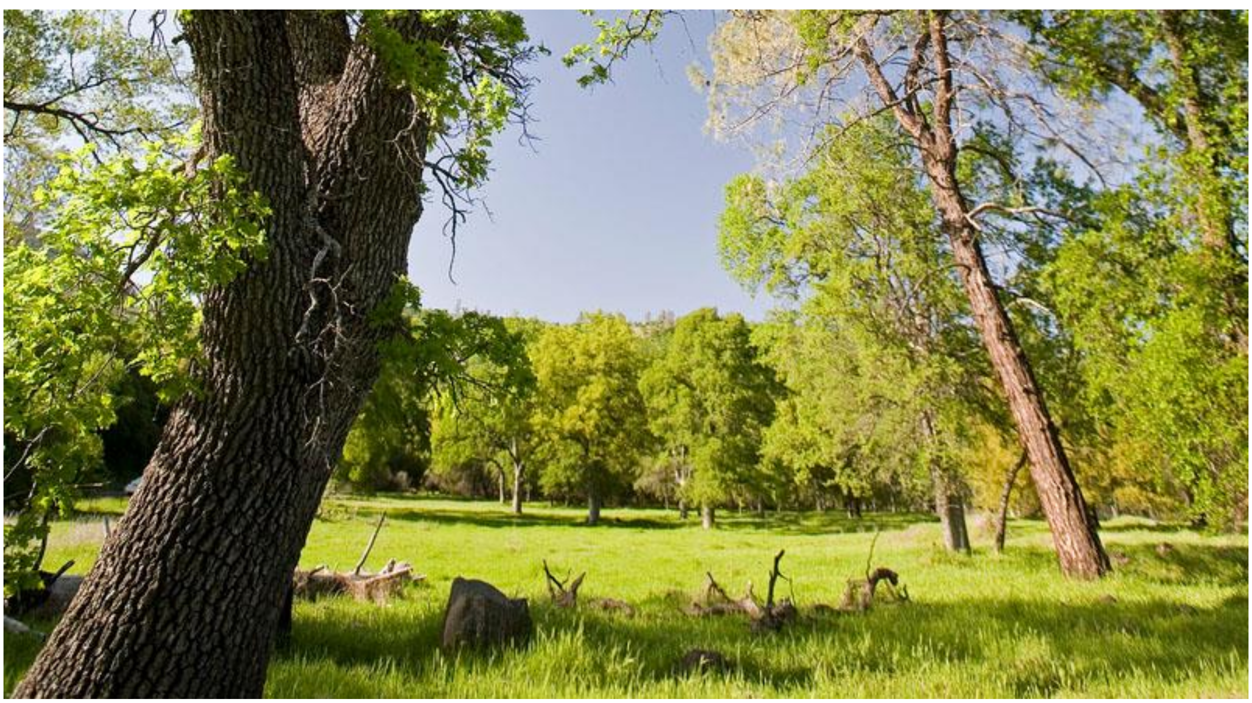
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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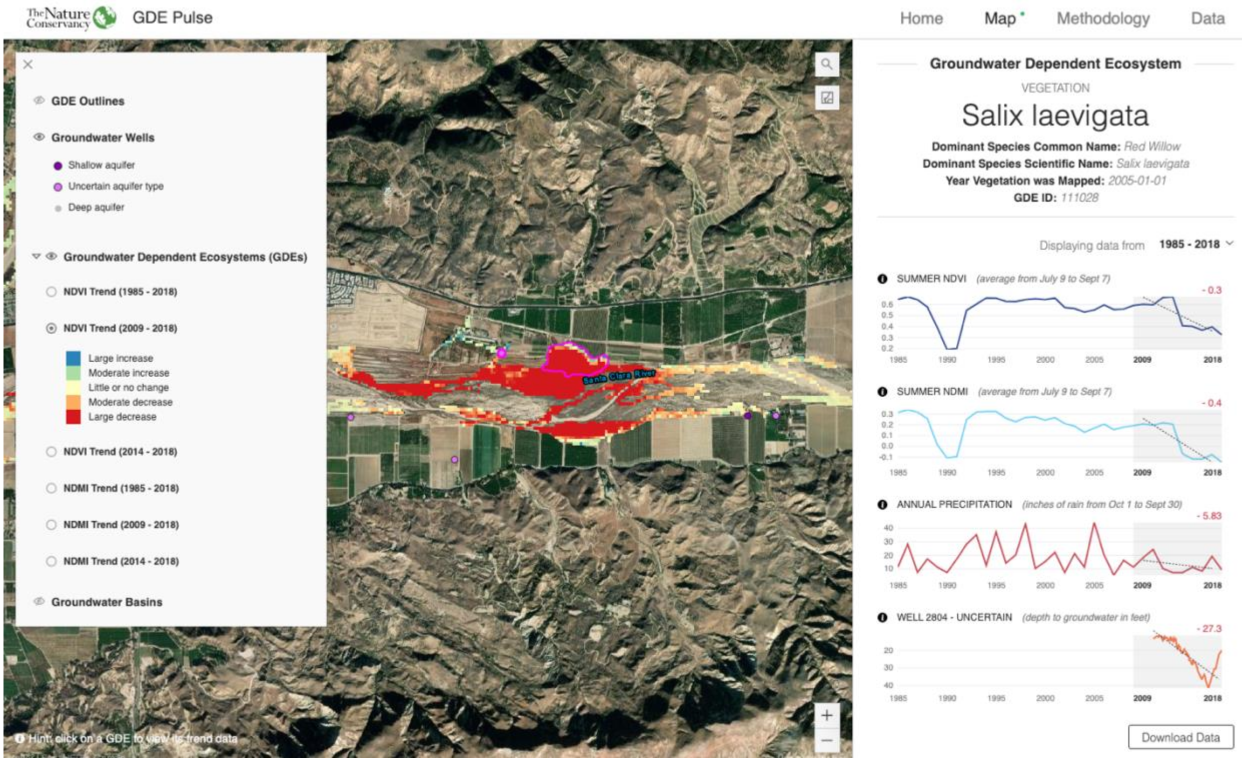
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

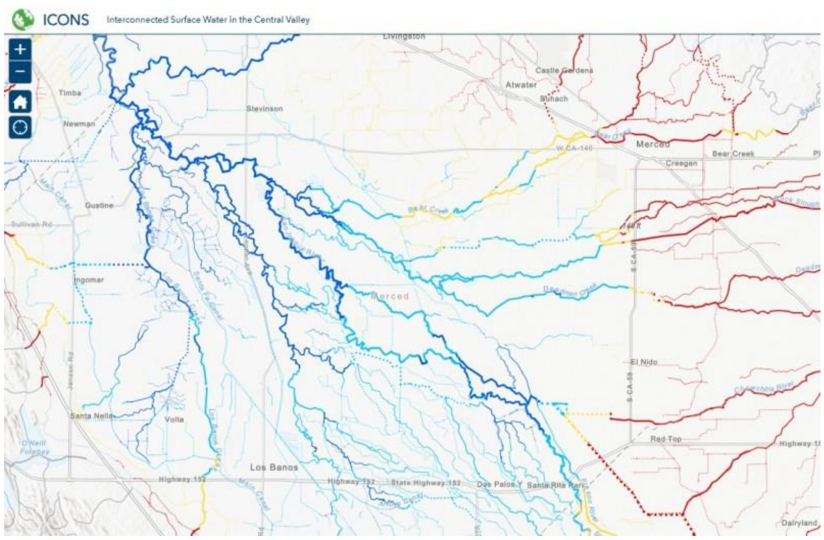
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Enterprise Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Enterprise Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			

Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Strix nebulosa	Great Gray Owl		Endangered	
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
Crangonyx spp.	Crangonyx spp.			
Hyalella spp.	Hyalella spp.			
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013

Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endangered	Endangered	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Ascaphus truei	Coastal Tailed Frog			
Dicamptodon tenebrosus	Pacific Giant Salamander			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Thamnophis couchii	Sierra Gartersnake			
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Ablabesmyia spp.	Ablabesmyia spp.			
Acentrella insignificans	A Mayfly			
Acentrella spp.	Acentrella spp.			
Agapetus spp.	Agapetus spp.			
Ambrysus mormon				Not on any status lists
Ambrysus spp.	Ambrysus spp.			
Ameletus amador	A Mayfly			

Ameletus spp.	Ameletus spp.			
Amiocentrus aspilus	A Caddisfly			
Anax junius	Common Green Darner			
Antocha monticola				Not on any status lists
Apedilum spp.	Apedilum spp.			
Argia lugens	Sooty Dancer			
Argia spp.	Argia spp.			
Attenella attenuata				Not on any status lists
Attenella spp.	Attenella spp.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brachycentridae fam.	Brachycentridae fam.			
Brachycentrus americanus	A Caddisfly			
Brachycentrus spp.	Brachycentrus spp.			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Brillia spp.	Brillia spp.			
Caenis latipennis	A Mayfly			
Calineuria californica	Western Stone			
Caudatella columbiella				Not on any status lists
Caudatella heterocaudata	A Mayfly			
Caudatella spp.	Caudatella spp.			
Centroptilum album	A Mayfly			
Centroptilum spp.	Centroptilum spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Choroterpes spp.	Choroterpes spp.			
Cinygma dimicki	A Mayfly			
Cinygma spp.	Cinygma spp.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Cleptelmis addenda				Not on any status lists
Conchapelopia spp.	Conchapelopia spp.			
Cricotopus spp.	Cricotopus spp.			

Cryptochironomus spp.	Cryptochironomus spp.			
Dicosmoecus atripes	A Caddisfly			
Dicosmoecus spp.	Dicosmoecus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Drunella coloradensis	A Mayfly			
Drunella spp.	Drunella spp.			
Dubiraphia spp.	Dubiraphia spp.			
Ecdyonurus criddlei	A Mayfly			
Enallagma cyathigerum				Not on any status lists
Epeorus albertae	A Mayfly			
Epeorus spp.	Epeorus spp.			
Ephemerella alleni				Not on any status lists
Ephemerella aurivillii	A Mayfly			
Ephemerella maculata	A Mayfly			
Ephemerella spp.	Ephemerella spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Erpetogomphus compositus	White-belted Ringtail			
Erythemis collocata	Western Pondhawk			
Eubrianax edwardsii				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon spp.	Fallceon spp.			
Glossosoma alascense	A Caddisfly			
Glossosoma spp.	Glossosoma spp.			
Glossosomatidae fam.	Glossosomatidae fam.			
Helicopsyche spp.	Helicopsyche spp.			
Heptageniidae fam.	Heptageniidae fam.			
Hesperoperla pacifica	Golden Stone			
Hetaerina americana	American Rubyspot			
Heterlimnius corpulentus				Not on any status lists
Heterlimnius spp.	Heterlimnius spp.			

Hydraena spp.	Hydraena spp.			
Hydrophilidae fam.	Hydrophilidae fam.			
Hydropsyche alternans				Not on any status lists
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila ajax	A Caddisfly			
Hydroptila spp.	Hydroptila spp.			
Isoperla acula	Fresno Stipetail			
Isoperla spp.	Isoperla spp.			
Laccobius spp.	Laccobius spp.			
Lara avara				Not on any status lists
Lara spp.	Lara spp.			
Larsia spp.	Larsia spp.			
Lepidostoma acarolum				Not on any status lists
Lepidostoma spp.	Lepidostoma spp.			
Leptoceridae fam.	Leptoceridae fam.			
Lestes stultus	Black Spreadwing			
Libellula luctuosa	Widow Skimmer			
Libellula pulchella	Twelve-spotted Skimmer			
Libellula saturata	Flame Skimmer			
Malenka bifurcata				Not on any status lists
Malenka spp.	Malenka spp.			
Marilia flexuosa	A Caddisfly			
Micropsectra spp.	Micropsectra spp.			
Mideopsis spp.	Mideopsis spp.			
Narpus angustus				Not on any status lists
Narpus spp.	Narpus spp.			
Nectopsyche spp.	Nectopsyche spp.			
Neoclypeodytes leachi				Not on any status lists
Oecetis spp.	Oecetis spp.			
Optioservus canus	Pinnacles Optioservus Riffle Beetle		Special	
Optioservus quadrimaculatus				Not on any status lists

Optioservus spp.	Optioservus spp.			
Ordobrevia nubifera				Not on any status lists
Orohermes crepusculus				Not on any status lists
Osobenus yakimae	Yakima Springfly			
Oxyethira spp.	Oxyethira spp.			
Paracladopelma spp.	Paracladopelma spp.			
Paraleptophlebia altana	A Mayfly			
Paraleptophlebia spp.	Paraleptophlebia spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Pentaneura spp.	Pentaneura spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			
Progomphus borealis	Gray Sanddragon			
Psectrocladius spp.	Psectrocladius spp.			
Psephenus falli				Not on any status lists
Pseudochironomus spp.	Pseudochironomus spp.			
Pteronarcys californica	Giant Salmonfly			
Pteronarcys spp.	Pteronarcys spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhithrogena decora	A Mayfly			
Rhithrogena spp.	Rhithrogena spp.			
Rhyacophila acuminata	A Caddisfly			Not on any status lists
Rhyacophila spp.	Rhyacophila spp.			
Serratella levis	A Mayfly			
Serratella micheneri	A Mayfly			
Serratella spp.	Serratella spp.			
Simulium anduzei				Not on any status lists
Simulium spp.	Simulium spp.			
Skwala americana	American Springfly			
Sperchon spp.	Sperchon spp.			

Sperchon stellata				Not on any status lists
Stictotarsus striatellus				Not on any status lists
Stylurus spp.	Stylurus spp.			
Sweltsa adamantea				Not on any status lists
Sweltsa spp.	Sweltsa spp.			
Tanytarsus spp.	Tanytarsus spp.			
Tinodes spp.	Tinodes spp.			
Tipulidae fam.	Tipulidae fam.			
Tramea lacerata	Black Saddlebags			
Tricorythodes spp.	Tricorythodes spp.			
Uvarus subtilis				Not on any status lists
Zaitzevia parvula				Not on any status lists
Zaitzevia spp.	Zaitzevia spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Gonidea angulata	Western Ridged Mussel		Special	
Helisoma spp.	Helisoma spp.			
Lymnaea spp.	Lymnaea spp.			
Lymnaea stagnalis	Swamp Lymnaea			Not on any status lists
Margaritifera falcata	Western Pearlshell		Special	
Physa acuta	Pewter Physa			Not on any status lists
Physa spp.	Physa spp.			
Pisidium casertanum				Not on any status lists
Pisidium spp.	Pisidium spp.			
PLANTS				

Legenere limosa	False Venus'-looking-glass		Special	CRPR - 1B.1
Limnanthes floccosa floccosa	Woolly Meadowfoam		Special	CRPR - 4.2
Orcuttia tenuis	Slender Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Alnus rhombifolia	White Alder			
Arundo donax	NA			
Carex longii	NA			Not on any status lists
Carex vulpinoidea	NA			
Cephalanthus occidentalis	Common Buttonbush			
Cyperus squarrosus	Awned Cyperus			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis quadrangulata	NA			
Eryngium articulatum	Jointed Coyote-thistle			
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Isoetes howellii	NA			
Juncus effusus effusus	NA			
Juncus effusus pacificus				
Leersia oryzoides	Rice Cutgrass			
Limnanthes alba alba	White Meadowfoam			
Lipocarpha micrantha	Dwarf Bulrush			
Mimulus guttatus	Common Large Monkeyflower			
Mimulus pilosus				Not on any status lists

Perideridia howellii	Howell's False Caraway			
Plagiobothrys greenei	Greene's Popcorn-flower			
Populus trichocarpa	NA			Not on any status lists
Rhododendron occidentale occidentale	Western Azalea			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

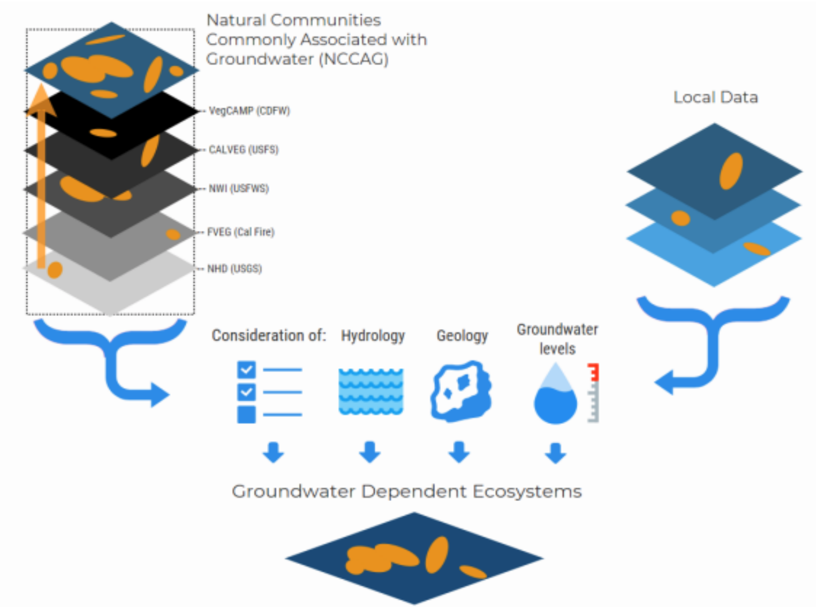


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

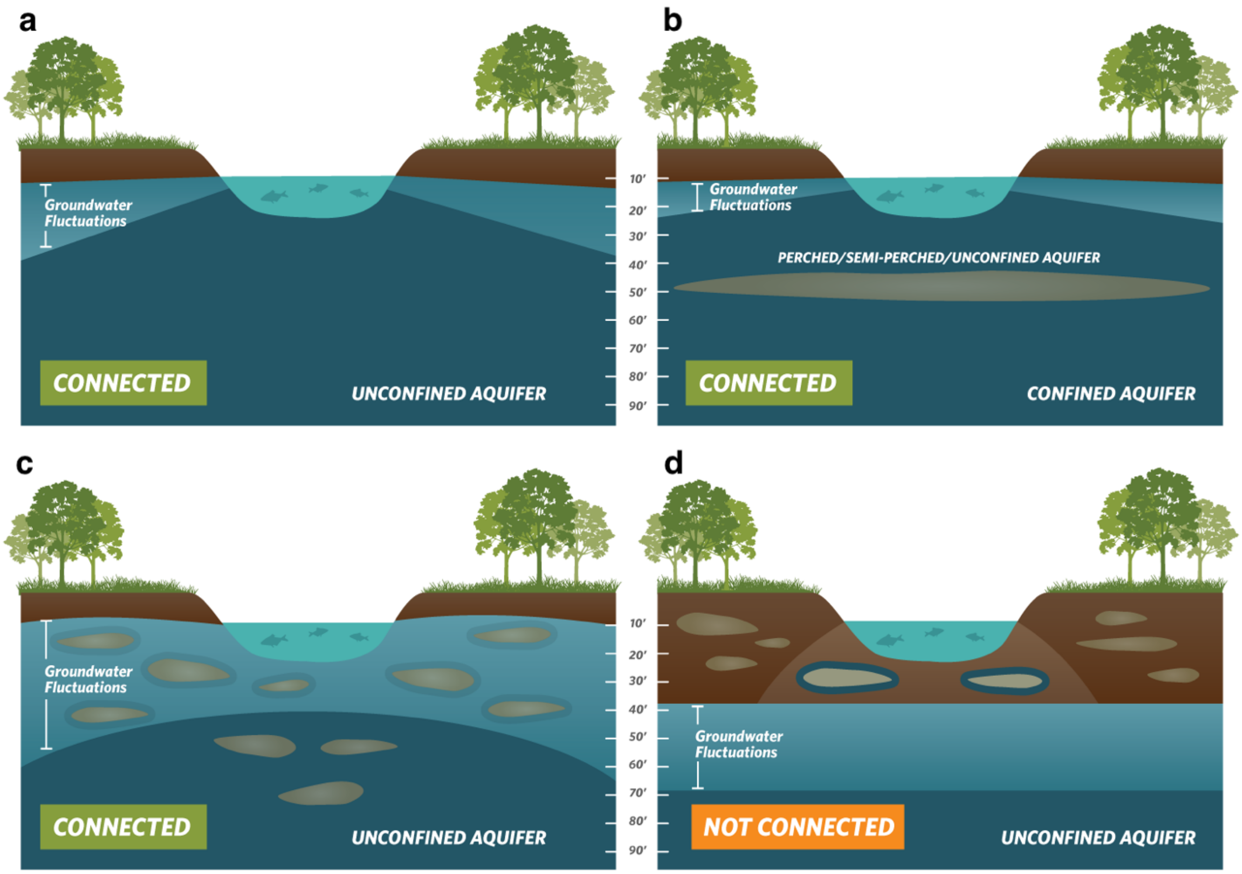

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

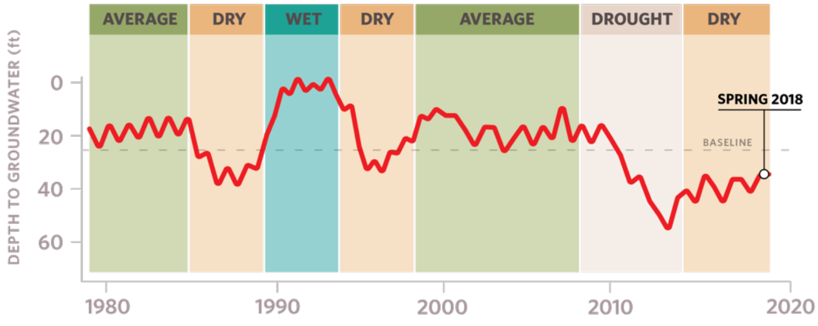

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

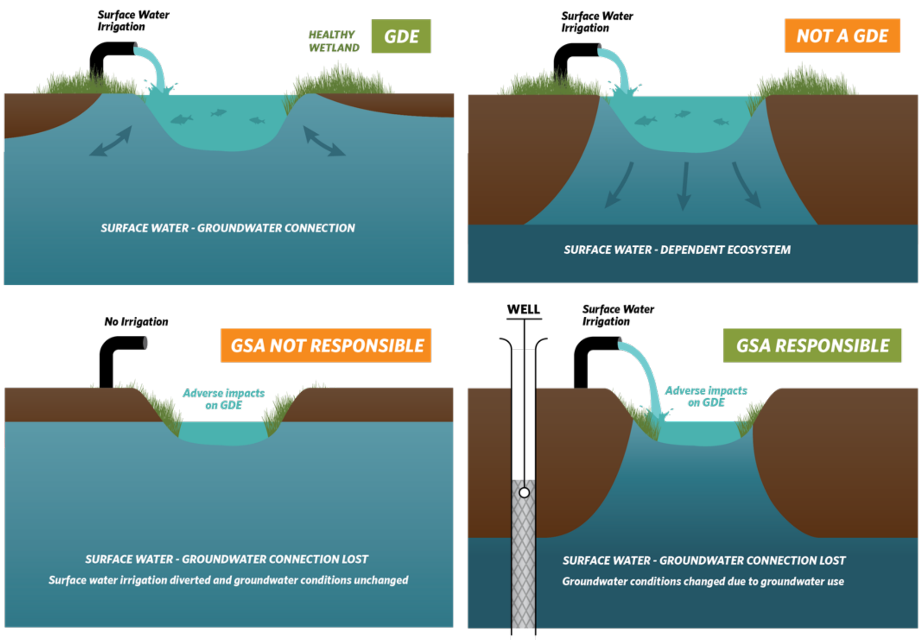

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

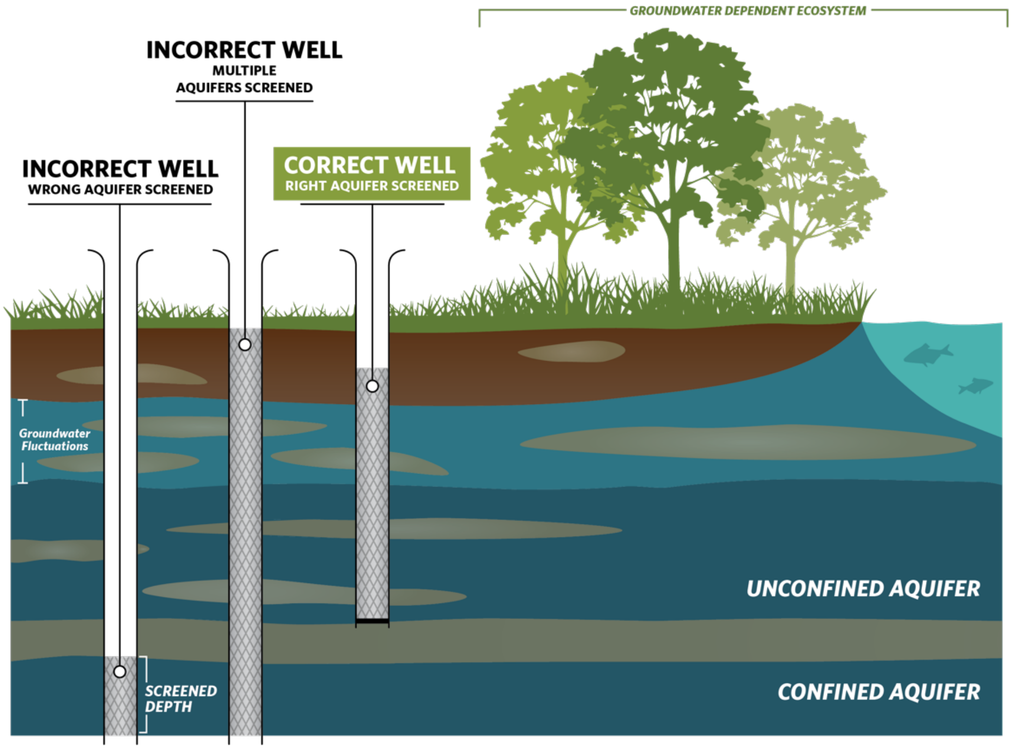

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

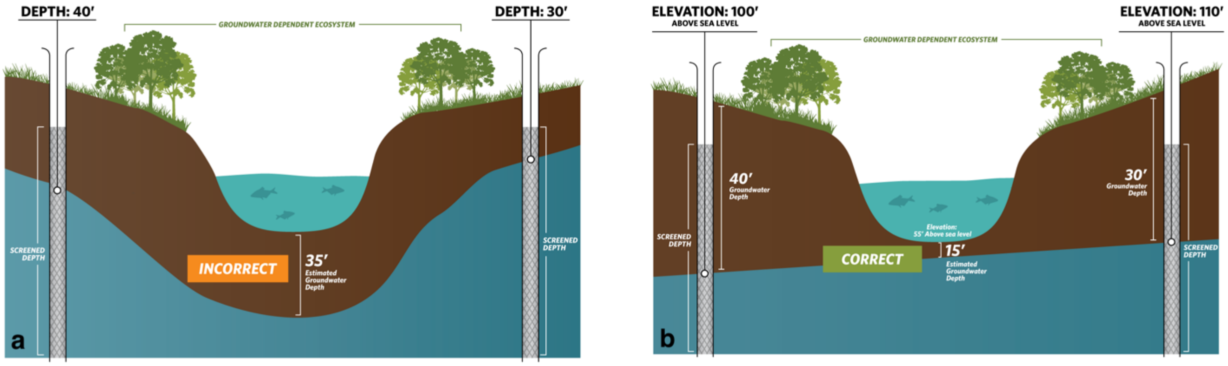

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

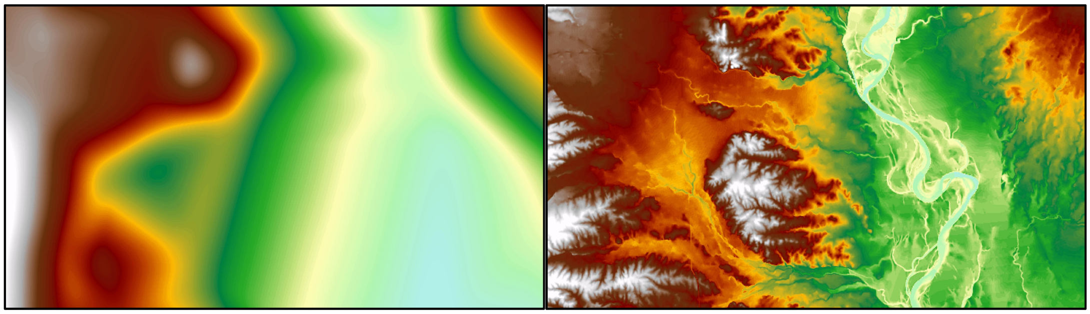

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

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[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

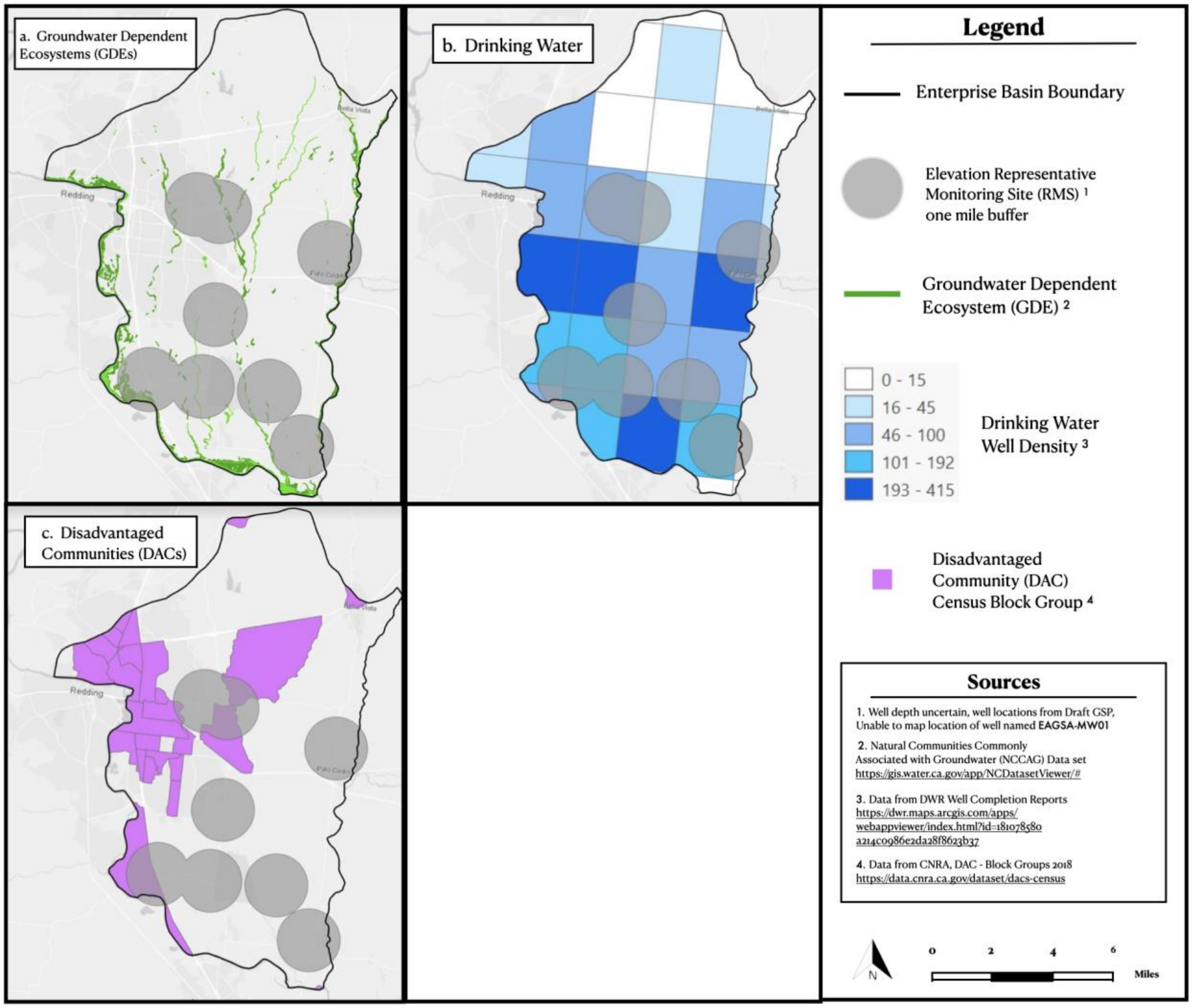

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

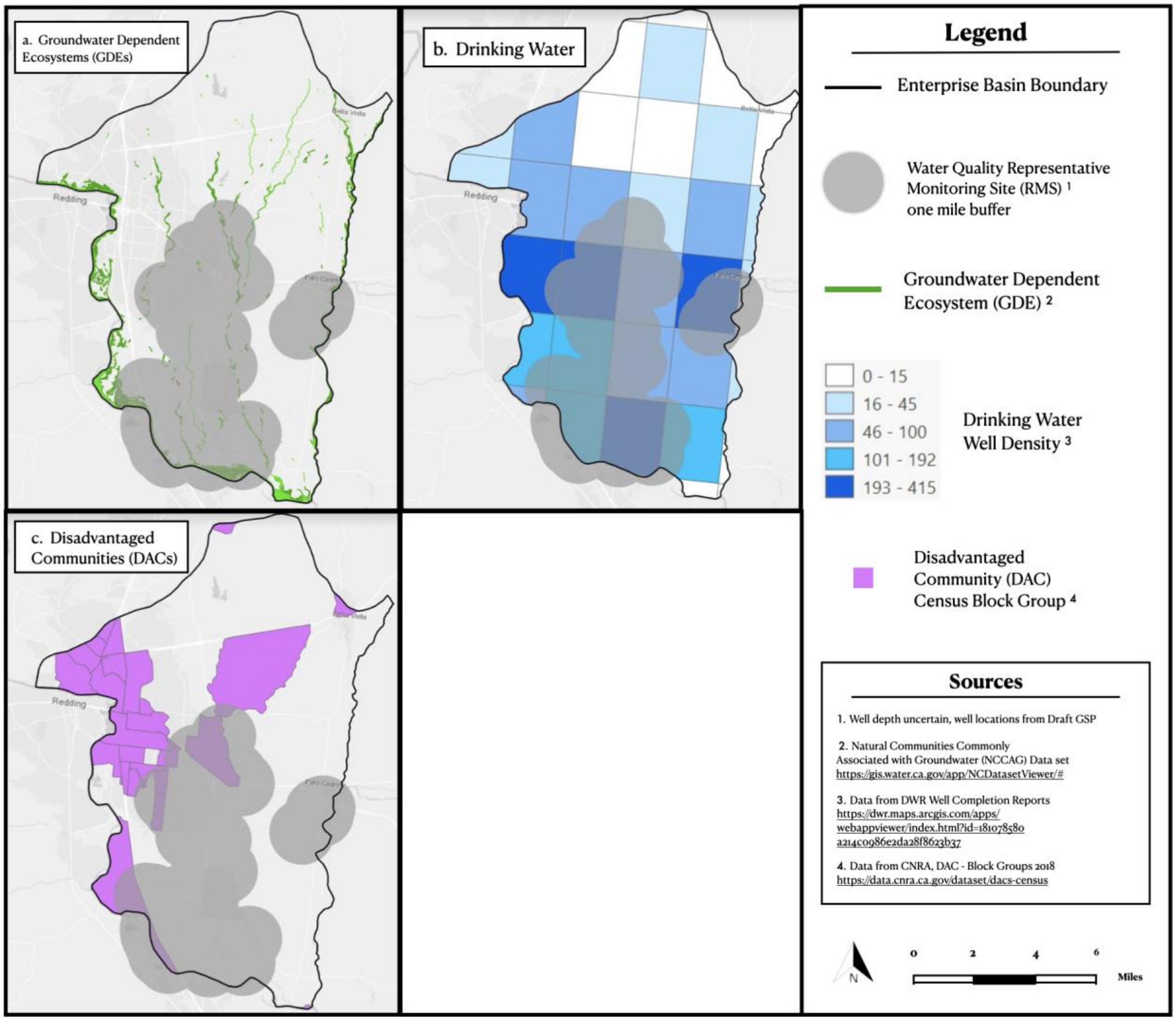

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

October 9, 2021

Fillmore and Piru Basins Groundwater Sustainability Agency
PO Box 1110
Fillmore, CA 93016

Submitted via email: evai@unitedwater.org

Re: Public Comment Letter for the Fillmore Basin Draft GSP

Dear Eva Ibarra,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Fillmore Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Fillmore Basin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
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Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Fillmore Basin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. The GSP provides a map of DACs by block group (Figure 2-1.4). However, the plan does not document the population for each DAC. The GSP also failed to include the population dependent on groundwater as their source of drinking water in the basin.

The GSP provides a density map of domestic wells in the basin. However, the plan fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the basin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Include a map showing domestic well locations and average well depth across the basin. • Provide the population of each identified DAC. • Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. To assess ISWs, the plan refers to a previous report by United Water Conservation District, included in the GSP as Appendix E. This Appendix describes a numerical model developed for a regional area that includes the Fillmore Basin.

The main text of the GSP presents a summary of annual depletions of ISW in the Fillmore Basin at two locations of the Santa Clara River. The ISW section of the GSP concludes with the statement (p. 2-59): "Data gaps remain regarding identifying the extent and timing of interconnectedness of other stream channel areas (e.g., Sespe Creek and central portions of the Santa Clara River), due to a lack of paired groundwater level and surface water level monitoring sites. Stream conditions here are considered to vary between all three stream conditions depicted on Figure 2.2-29. The significance of interconnected surface water and groundwater conditions at these areas is less than that of the two primary areas of rising groundwater, because surface water exists in these reaches much less often (Figure 2.2-12), and therefore, provides less opportunity for beneficial uses related to aquatic habitat or surface water diversions." However, no map is provided to show the stream reaches to which this statement refers. Without a map of labeled stream reaches in the basin, it is difficult to understand the location of these reaches, and whether the GSP has included them as potential ISWs in the GSP. In addition, it is unclear whether the GSP is only considering ISWs in areas with "rising groundwater" (gaining conditions). Under SGMA's ISW definition[1], they must also include losing reaches that maintain a connection with the saturated zone at *any* point in time and space.

RECOMMENDATIONS
● Provide a map showing all the stream reaches in the basin, with reaches clearly labeled with stream name and interconnected or disconnected. ● Provide more discussion in the GSP about the groundwater elevation data and streambed elevation data used to verify interconnected reaches. Include a map of the interpolated groundwater elevations and spatial extent of groundwater monitoring wells used to produce the map. Discuss screening depth of monitoring wells and ensure they are monitoring the shallow principal aquifer. ● Overlay the stream reaches shown with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. ● On the ISW map, clearly label the areas with data gaps. While the GSP clearly identifies data gaps and their locations in the text, we recommend that the GSP considers any segments with data gaps as potential ISWs and clearly marks them as such on maps provided in the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **incomplete**. We commend the GSA for their comprehensive evaluation of GDEs in the basin, as presented in the GDE Technical Memorandum (Appendix D). The GSP mapped GDEs and potential GDEs using multiple sources, including the NC Dataset (also referred to in the GSP as the iGDE database), California Department of Fish and Wildlife (CDFW) VegCAMP, US Department of Agriculture (USDA) CalVeg, and National Wetlands Inventory data. Table 2.2-5 describes the type of GDEs in

[1] "'Interconnected surface water' refers to surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted." [23 CCR §351(o)]

the basin with dominant flora species and acreage within the basin. Table 2.2-7 presents the critical habitat and special status species in the basin.

The Appendix states (p. 21): "In light of the limitations of the monitoring well data, the groundwater elevation data presented in this section are intended to illustrate general trends within GDE units. The spring 2019 depth to water surface (Section 2.1.2), as opposed to monitoring well data, is used to establish GDE connectivity with shallow groundwater." The Appendix describes the challenges with using groundwater monitoring well data for some of the GDE units and explains that 2019 groundwater levels are conservative for GDE mapping. However, we would like to see additional discussion and use of groundwater data from the pre-SGMA benchmark date of 2015 where available (e.g., pre-drought 2011 water levels) to determine which GDE units are connected to groundwater.

Furthermore, we found that some mapped features in the NC dataset were improperly disregarded (i.e., coastal live oak (*Quercus agrifolia*) on slopes). NC dataset polygons were incorrectly excluded for mapped vegetation growing on a clear slope, based on landscape position and improbable connection to groundwater. However, without groundwater data, there is no way to confirm that these NC dataset polygons are not GDEs. If no data are available, then these polygons should be retained as potential GDEs.

RECOMMENDATIONS

- For GDE units where groundwater elevation data are available, we recommend the pre-SGMA period of 2005-2015 be used to verify a connection to groundwater. If complete data from this period are not available, consider the use of data from 2011 (a wet year) since it is before the SGMA benchmark date of 2015.

- Re-evaluate the NC dataset polygons that were removed based on their location on a slope. If groundwater elevation data are not available to verify connection to groundwater, retain these polygons as potential GDEs in the GSP.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[2,3] to be included in the water budget. The integration of native vegetation into the water budget is **sufficient**. We commend the GSA for including the groundwater demands of this ecosystem in the historical, current and projected water budgets. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATION

- State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

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[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders[4] is not fully met by the description in the Communication and Engagement Plan (Appendix B). We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms. They include attendance at public meetings, a stakeholder email list, updates to the GSP website and social media, and information shared at meetings held by other local agencies and organizations. There is no specific outreach during the GSP development process described for environmental stakeholders and domestic well owners.

- The Communication and Engagement Plan does not include a detailed plan for continual opportunities for engagement through the implementation phase of the GSP that is specifically directed to environmental stakeholders.

RECOMMENDATION
• Include a more detailed and robust Communication and Engagement Plan that describes active and targeted outreach to engage DAC members, domestic well owners, and environmental stakeholders during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[5] and establishing minimum thresholds.[6,7]

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[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

[5] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[6] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[7] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP mentions impacts to DACs and domestic drinking water wells when defining undesirable results. The GSP states (p. 3-3): “Groundwater levels below the base of well perforations (or screen intervals) prevents beneficial uses (i.e., domestic) and users (i.e., DACs) from benefiting from the California Human Right to Water due to dry well conditions.” However, the GSP does not sufficiently describe how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results in the basin. The measurable objectives set for groundwater elevations do not consider DACs and drinking water users.

The GSP states (2-43): “Historically water quality chemicals (analytes or constituents) of concern (COCs) in the Fillmore and Piru basins have generally included, but are not necessarily limited to, the following analytes: Total Dissolved Solids (TDS), Sulfate, Chloride, Nitrate, and Boron.” The GSP further states (2-52): “Additional potential COCs in the Fillmore Basin were identified [as] Radiochemistry (gross alpha and uranium), Selenium, Lead, Iron, and Manganese.” The GSP states that the minimum thresholds for degraded water quality correspond with water quality objectives (WQOs) and maximum contaminant levels (MCLs) established by the Los Angeles Regional Water Quality Control Board (LARWQCB) Basin Plan and California Division of Drinking Water (DDW), respectively. However, they are not specifically provided in Section 3 (Sustainable Management Criteria) of the GSP.

For degraded water quality, the GSP does not discuss direct and indirect impacts on DACs or drinking water users when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders. The GSP does not set any measurable objectives for the degraded water quality sustainability indicator.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe further the direct and indirect impacts on DACs and drinking water users when defining undesirable results for chronic lowering of groundwater levels.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs and drinking water users within the basin. Further describe the impact of passing the minimum threshold for drinking water users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.

Degraded Water Quality

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to “Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act.”

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users.

- Include the minimum thresholds established for the identified COCs in Section 3 (Sustainable Management Criteria) of the GSP, instead of just stating that they align with drinking water standards.

- Set measurable objectives for the degraded water quality sustainability indicator.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

We commend the GSA for their comprehensive analysis of undesirable results for GDEs and ISWs. The GSP analyzes the impacts on GDEs when defining undesirable results for three sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, and depletions of interconnected surface waters).

For minimum thresholds, the GSP states (p. 3-9): "The MT for groundwater levels in the Cienega Restoration / Fish Hatchery area is set at the critical water level (Kibler, 2021 and Kibler et al., 2021), 10 ft below 2011 low groundwater levels (i.e., the MO). If/when this MT is exceeded, mitigation (Section 4) will be implemented to offset the undesirable result that would occur without adequate soil moisture." The GSP does not, however, assess the impacts of minimum thresholds on the other GDEs in the basin.

The GSP notes that the Cienega Riparian Complex has historically shown the greatest degradation due to groundwater levels (p. 2-80). It also describes this impact as an undesirable result due to groundwater levels declining, resulting in (p. 3-4) "die off of riparian vegetation (e.g., cottonwood or willow species in the Cienega Riparian Complex GDE unit), due to groundwater level declines below the critical water level, that are attributable to groundwater pumping." If the minimum threshold is exceeded, the referenced mitigation action will require months or years to implement. However, there is no discussion of interim pumping reductions or other actions that could have an immediate positive impact on the undesirable result.

RECOMMENDATIONS

- Provide explicit discussion of how the minimum threshold (10 feet below 2011 groundwater levels) will prevent undesirable results specifically for all GDEs in the basin, not just those in the Cienega Restoration / Fish Hatchery area.
- State directly what the depth to groundwater corresponds to under the GDEs for the proposed minimum threshold (10 feet below 2011 groundwater levels).
- Consider GDEs when establishing measurable objectives and evaluate the measurable objectives based on GDE water needs.

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[8] require integration of climate

[8] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2070. However, the GSP does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

We acknowledge and commend the inclusion of climate change into key inputs (e.g., precipitation, evaporation, and surface water flow) of the projected water budget. Additionally, the sustainable yield is calculated based on the projected pumping with climate change incorporated. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extreme wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs and domestic wells in the basin.

Figure 2.1-8 (Existing Groundwater Elevation Monitoring Programs Map) and Figure 2.1-9 (Existing Groundwater Quality Monitoring Programs Map) show that no monitoring wells are located across portions of the basin near DACs and domestic wells. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[9].

The GSP provides comprehensive discussion of data gaps for GDEs and ISWs. Section 3.5.4.4.2 (Potential New Monitor Wells) discusses plans to include installation of new shallow monitoring wells to provide water level data around GDEs and ISWs, which is further described in Appendix D (Assessment of Groundwater Dependent Ecosystems for the Fillmore and Piru Basins Groundwater Sustainability Agency) and Appendix K (Monitoring Network and Data Gaps). However, this information is scattered across several locations in the GSP without a comprehensive set of maps provided.

[9] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

RECOMMENDATIONS
- Provide maps that overlay monitoring well locations with the locations of DACs and domestic wells to clearly identify potentially impacted areas. Increase the number of representative monitoring points (RMPs) in the shallow aquifer across the basin for the groundwater elevation and water quality groundwater condition indicators. Prioritize proximity to DACs and drinking water users when identifying new RMPs.   - Provide maps that overlay existing and proposed monitoring well locations with the locations of GDEs and ISWs to clearly identify potentially impacted areas.   - Describe further the biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the basin. Appendix D discusses remote sensing of GDEs using NDVI or other data to monitor the health of GDEs through time, but few details are provided.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to beneficial users of groundwater such as DACs and drinking water users.

We commend the GSA for including several projects and management actions with explicit benefits to the environment. However, the GSP does not discuss the manner in which DACs and drinking water users may be benefitted or impacted by projects and management actions identified in the GSP. Potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

The plan's commitment to mitigate the undesirable result on the Cienega Riparian Complex GDE is insufficient. The plan is confusing in that the mitigation refers only to the Cienega Springs Restoration project and does not seem to propose any mitigation for the Cienega Riparian Complex GDE. Furthermore, it is not clear how proposed projects 1 & 2 would mitigate impacts to the Cienega Riparian Complex GDE even if it is part of the Cienega Springs Restoration project area.

RECOMMENDATIONS
- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.   - For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.   - For GDEs, include the following: 1) Add a map showing the locations of the Cienega Riparian Complex GDE and the Cienega Springs Restoration project, 2) Explain how

the proposed management actions will mitigate the undesirable result occurring at the Cienega Riparian Complex GDE, 3) Develop immediate and longer term management actions to address the undesirable result occurring at the Cienega Riparian Complex (e.g., immediate pumping reductions when the minimum threshold is reached, non-native vegetation removal should die-off occur).

- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[10].

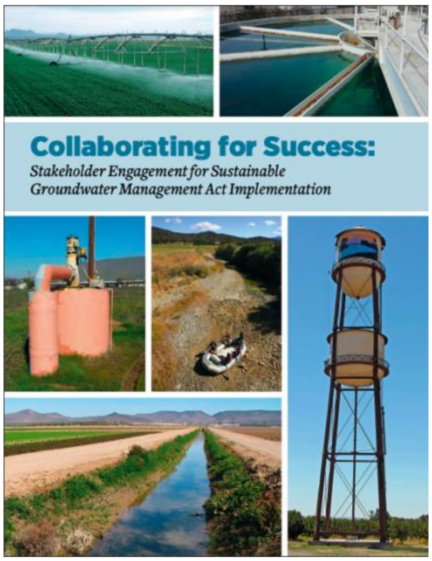
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[10] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



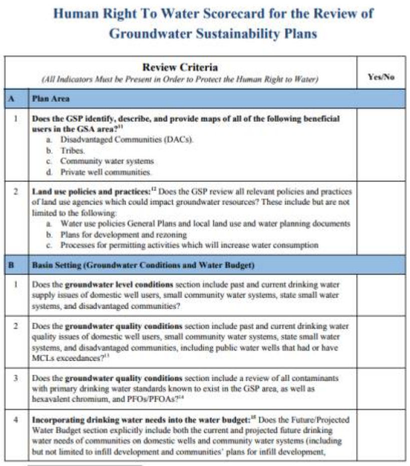
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

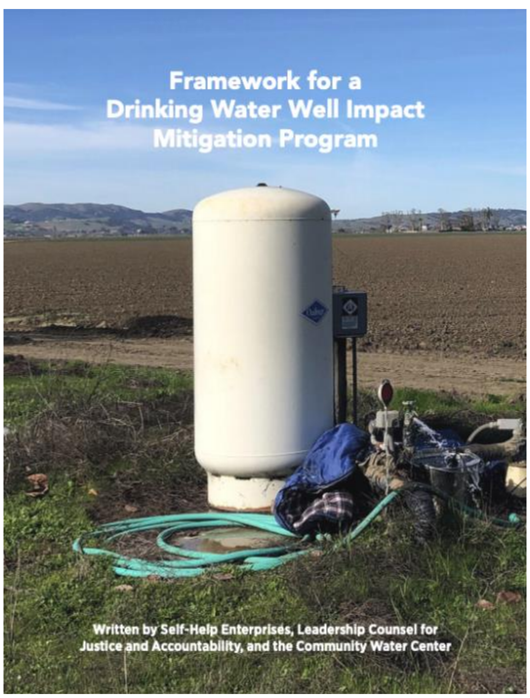


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

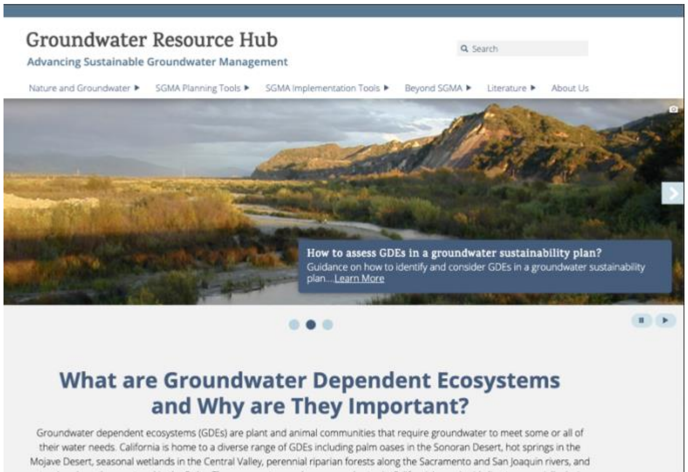
The [Human Right to Water Scorecard](#) was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



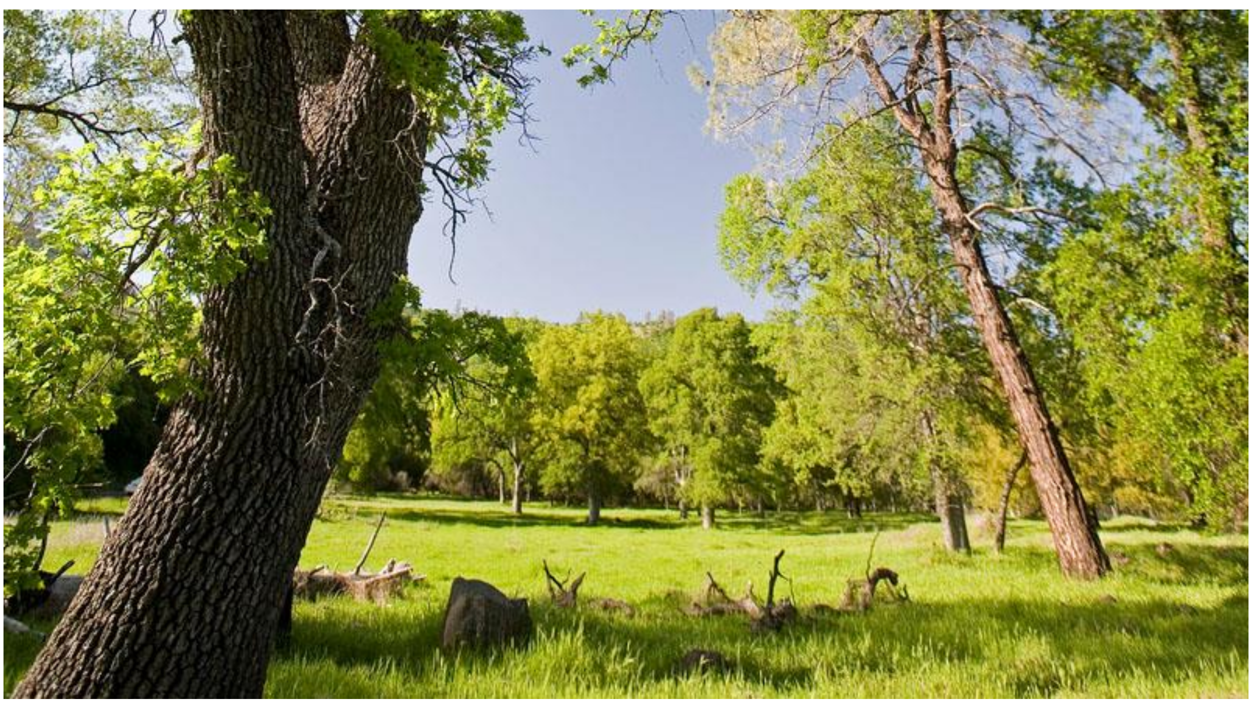
The [Drinking Water Well Impact Mitigation Framework](#) was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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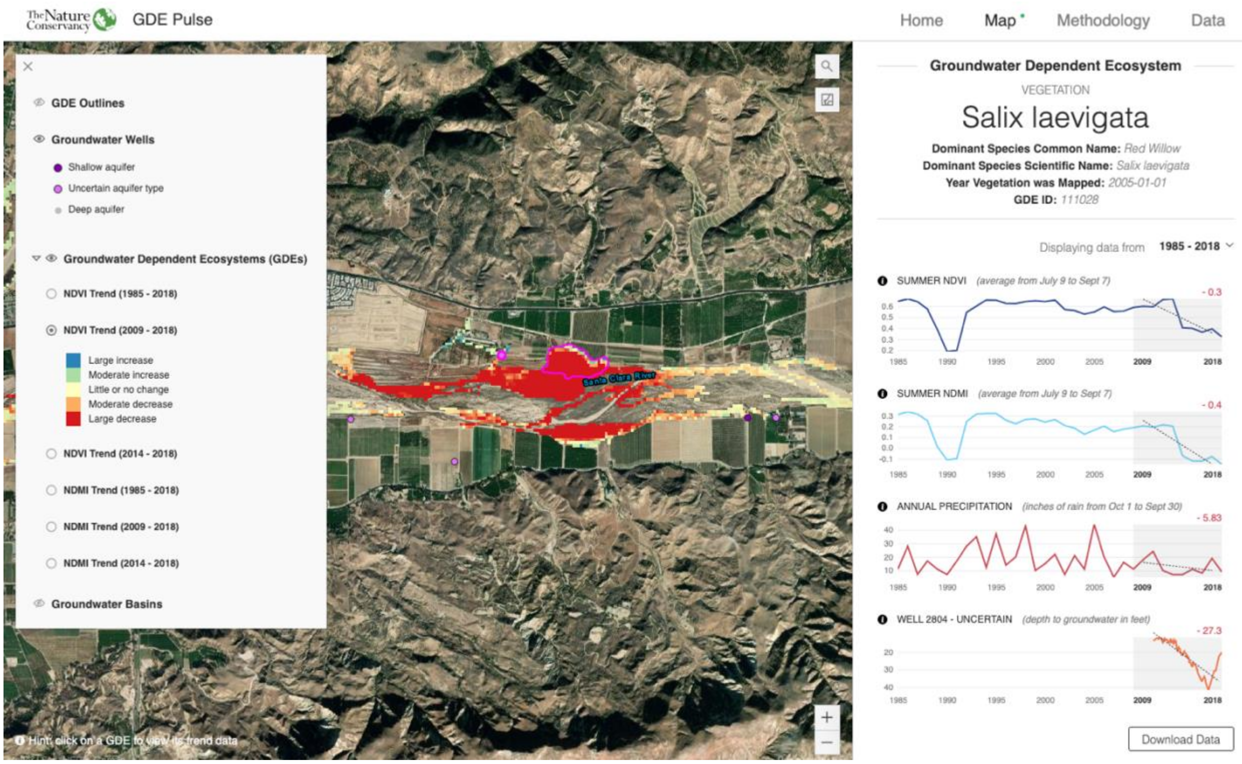
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

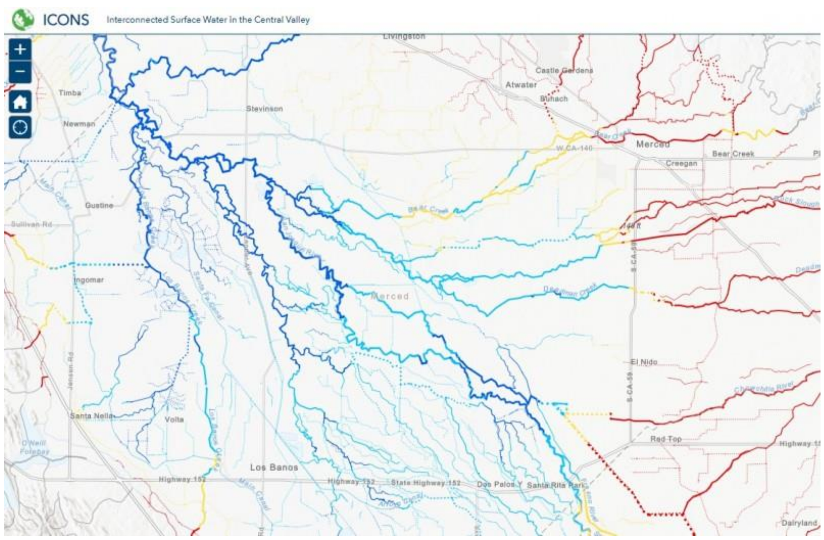
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data [available online](#) from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Fillmore Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Fillmore Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Empidonax traillii extimus	Southwestern Willow Flycatcher	Endangered	Endangered	
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Actitis macularius	Spotted Sandpiper			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Botaurus lentiginosus	American Bittern			
Butorides virescens	Green Heron			
Cistothorus palustris palustris	Marsh Wren			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Nycticorax nycticorax	Black-crowned Night-Heron			
Phalacrocorax auritus	Double-crested Cormorant			
Plegadis chihi	White-faced Ibis		Watch list	
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Vireo bellii	Bell's Vireo			
CRUSTACENAS				
Cyprididae fam.	Cyprididae fam.			
Hyalella spp.	Hyalella spp.			
FISHES				
Catostomus santaanae	Santa Ana sucker	Threatened	Special Concern	Endangered - Moyle 2013
Gasterosteus aculeatus williamsoni	Unarmored threespine stickleback	Endangered	Endangered	Endangered - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus mykiss - Southern CA	Southern California steelhead	Endangered	Special Concern	Endangered - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern	ARSSC
Pseudacris cadaverina	California Treefrog			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			

INSECTS & OTHER INVERTS				
Abedus spp.	Abedus spp.			
Ambrysus californicus				Not on any status lists
Ambrysus spp.	Ambrysus spp.			
Anax walsinghami	Giant Green Darner			
Argia agrioides	California Dancer			
Argia lugens	Sooty Dancer			
Argia nahuana	Aztec Dancer			
Argia spp.	Argia spp.			
Aturidae fam.	Aturidae fam.			
Baetidae fam.	Baetidae fam.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Caenis spp.	Caenis spp.			
Callibaetis spp.	Callibaetis spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Choroterpes spp.	Choroterpes spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corisella spp.	Corisella spp.			
Corixidae fam.	Corixidae fam.			
Corydalus texanus				Not on any status lists
Cricotopus bicinctus				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Enochrus spp.	Enochrus spp.			
Epeorus spp.	Epeorus spp.			
Ephydridae fam.	Ephydridae fam.			
Erpetogomphus lampropeltis lampropeltis	Serpent Ringtail			
Erpetogomphus spp.	Erpetogomphus spp.			
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Hetaerina americana	American Rubyspot			
Hydropsyche spp.	Hydropsyche spp.			

Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ischnura denticollis	Black-fronted Forktail			
Labrundinia spp.	Labrundinia spp.			
Larsia spp.	Larsia spp.			
Lepidostoma spp.	Lepidostoma spp.			
Mesocapnia spp.	Mesocapnia spp.			
Micrasema spp.	Micrasema spp.			
Microcylloepus spp.	Microcylloepus spp.			
Microtendipes pedellus				Not on any status lists
Microtendipes spp.	Microtendipes spp.			
Mideopsis spp.	Mideopsis spp.			
Neotrichia spp.	Neotrichia spp.			
Oecetis disjuncta	A Caddisfly			
Oecetis spp.	Oecetis spp.			
Optioservus spp.	Optioservus spp.			
Ostrocerca spp.	Ostrocerca spp.			
Oxyethira spp.	Oxyethira spp.			
Paltothemis lineatipes	Red Rock Skimmer			
Paltothemis spp.	Paltothemis spp.			
Paracladopelma spp.	Paracladopelma spp.			
Paraleptophlebia spp.	Paraleptophlebia spp.			
Peltodytes spp.	Peltodytes spp.			
Pentaneura spp.	Pentaneura spp.			
Petrophila spp.	Petrophila spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			
Postelichus spp.	Postelichus spp.			
Procladius spp.	Procladius spp.			
Progomphus borealis	Gray Sanddragon			
Psephenus falli				Not on any status lists
Pseudochironomus spp.	Pseudochironomus spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Serratella micheneri	A Mayfly			
Sialis spp.	Sialis spp.			
Sigara spp.	Sigara spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Stictotarsus eximius				Not on any status lists
Stictotarsus spp.	Stictotarsus spp.			

Sympetrum illotum	Cardinal Meadowhawk			
Tanytarsus spp.	Tanytarsus spp.			
Thienemannimyia spp.	Thienemannimyia spp.			
Tinodes spp.	Tinodes spp.			
Tipulidae fam.	Tipulidae fam.			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus spp.	Tropisternus spp.			
Tvetenia spp.	Tvetenia spp.			
Zaitzevia spp.	Zaitzevia spp.			
Zavrelimyia spp.	Zavrelimyia spp.			
MAMMALS				
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Physa spp.	Physa spp.			
PLANTS				
Azolla filiculoides	NA			
Baccharis salicina				Not on any status lists
Berula erecta	Wild Parsnip			
Bidens laevis	Smooth Bur-marigold			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Isolepis cernua	Low Bulrush			
Ludwigia hexapetala	NA			Not on any status lists
Ludwigia peploides peploides	NA			Not on any status lists
Lythrum californicum	California Loosestrife			
Persicaria lapathifolia				Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phragmites australis australis	Common Reed			
Pluchea odorata odorata	Scented Conyza			
Stachys albens	White-stem Hedge-nettle			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

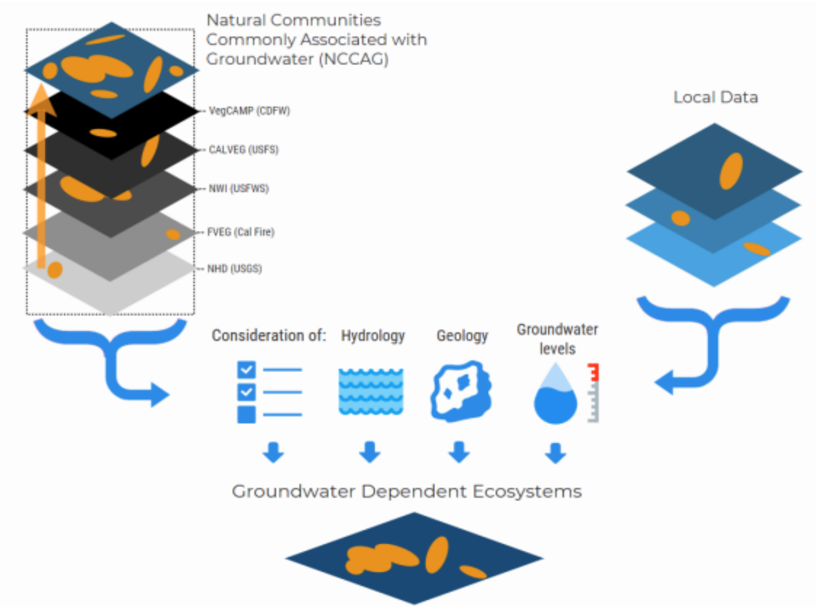


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

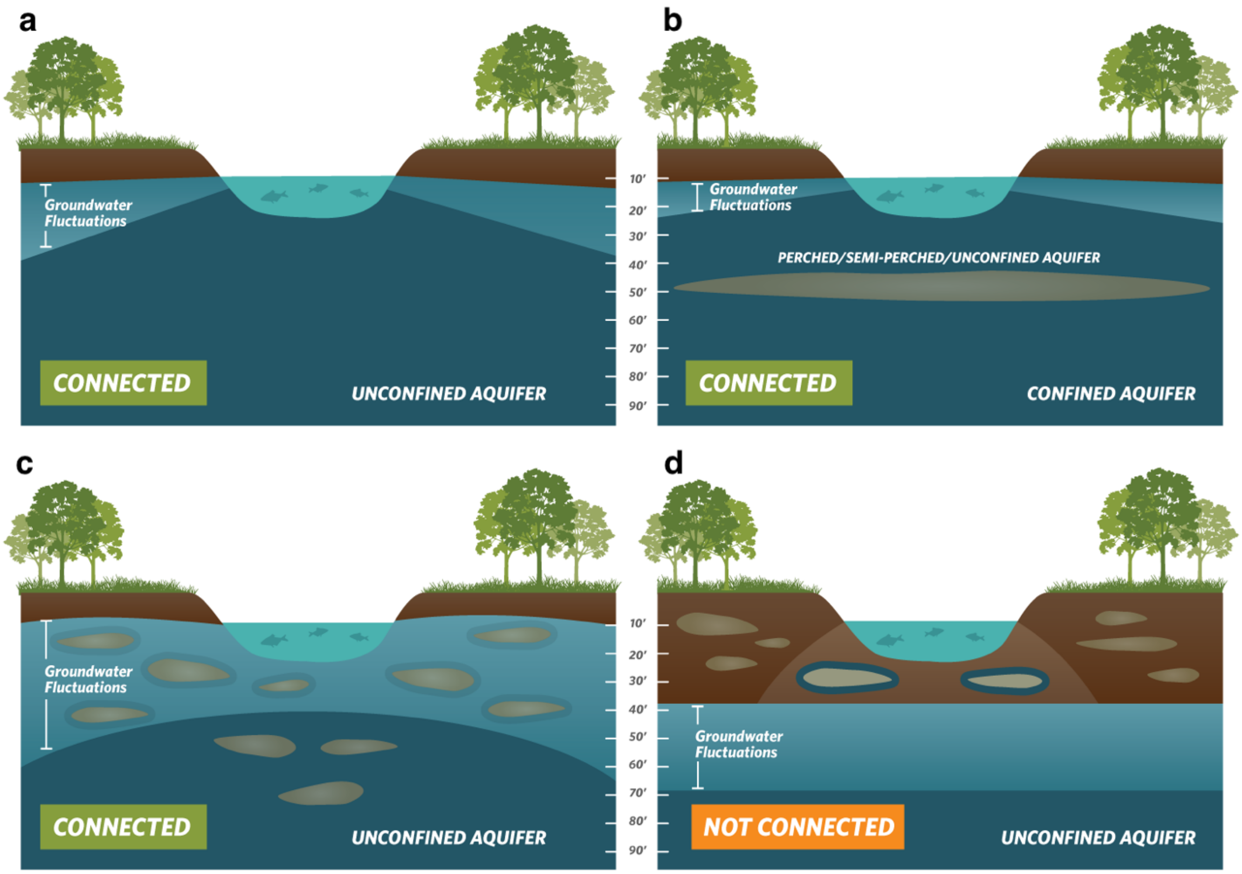

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

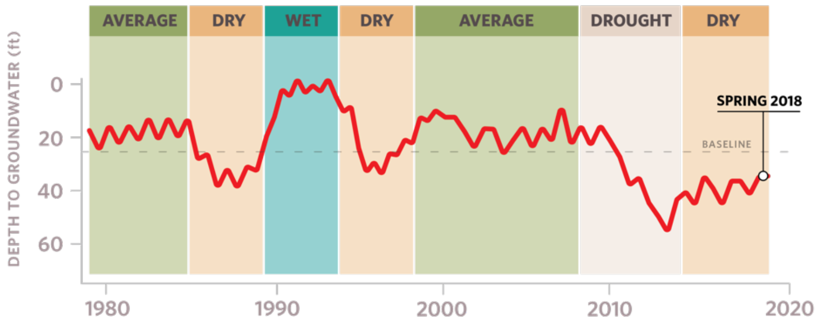

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

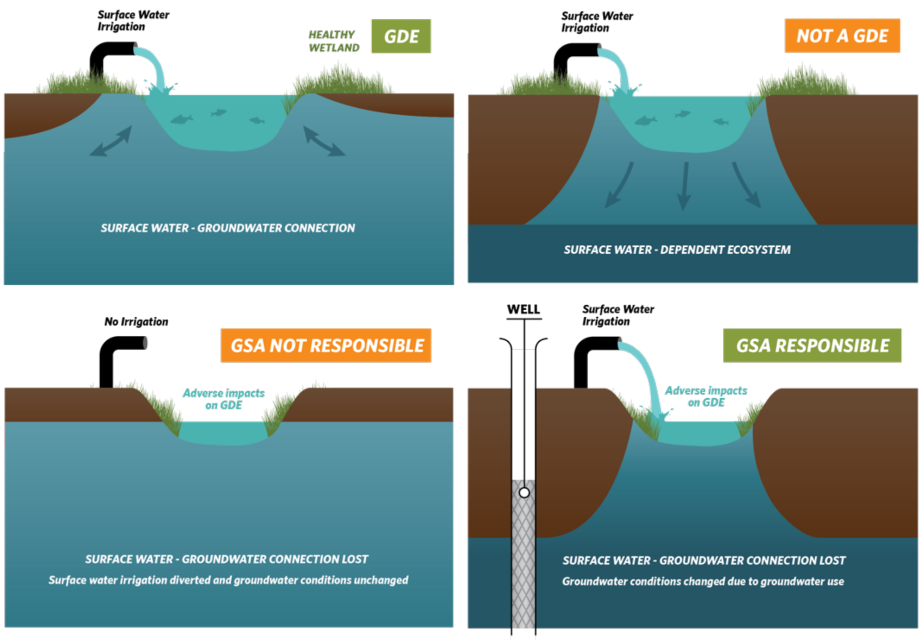

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

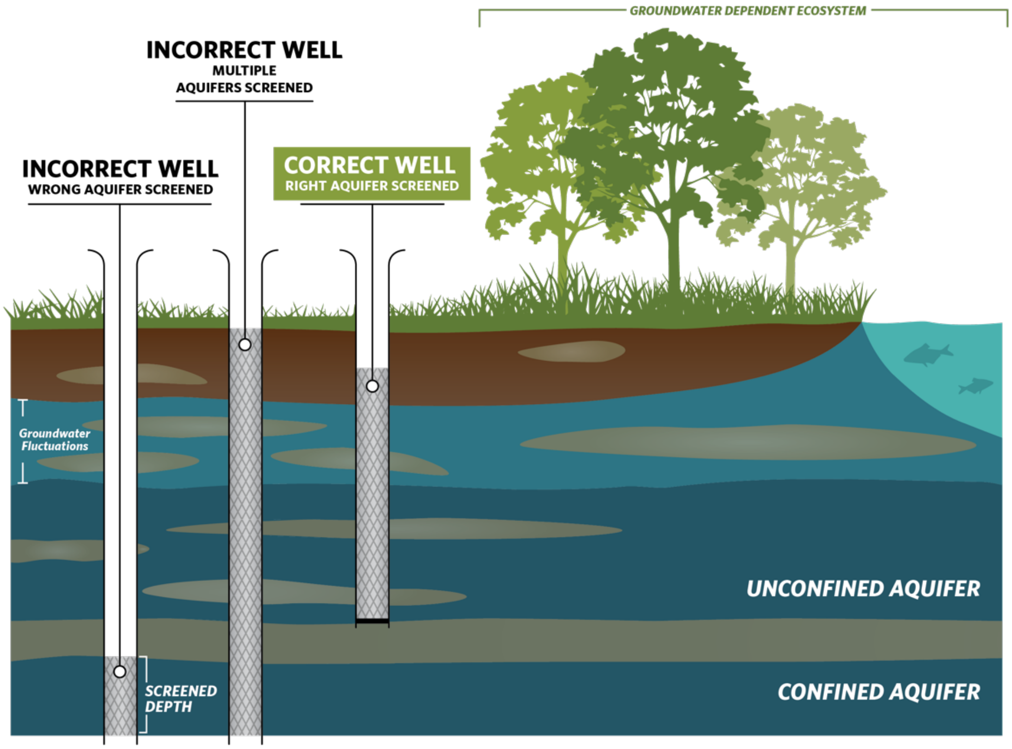

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

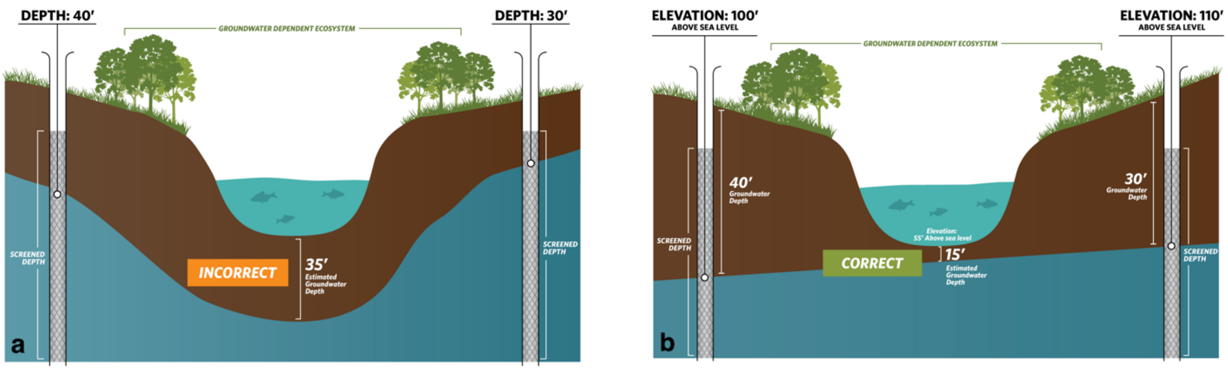

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

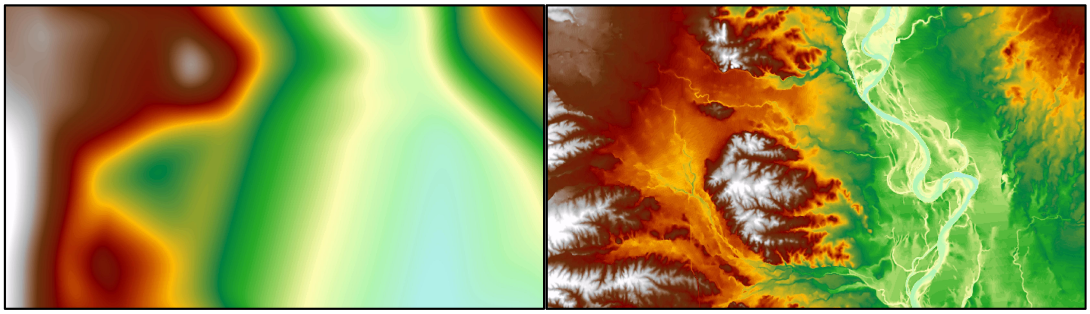

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

October 15, 2021

Salinas Valley Basin GSA
P.O. Box 1350
Carmel Valley, CA 93924

Submitted via web: https://form.jotform.com/201537036733047

Re: Public Comment Letter for Forebay Aquifer Subbasin Draft GSP

Dear Donna Meyers,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Forebay Aquifer Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Draft Forebay Aquifer Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

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Western States Climate and Water Scientist
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The Nature Conservancy

Heather Lukacs, Ph.D.
Director of Community Solutions
Community Water Center

Justine Massey
Policy Manager and Attorney
Community Water Center

Attachment A

Specific Comments on the Forebay Aquifer Subbasin Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP provides information on DACs, including identification by name and location on a map (Figure 2-3), and identifying the water source for DAC members. However, the GSP fails to identify the population of each identified DAC.

The GSP provides a density map of domestic wells in the subbasin. However, the GSP fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS
• Include a map showing domestic well locations and average well depth across the subbasin. • Provide the population of each identified DAC.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **insufficient**, due to lack of supporting information provided for the ISW analysis. To assess ISWs, the GSP used the Salinas Valley Integrated Hydrologic Model (SVIHM). The GSP states (p. 4-29): "*Although seepage along the ISW reaches is based on assumed channel and aquifer parameters as model inputs, the preliminary SVIHM is the best available tool to estimate ISW locations. The model construction and uncertainty are described in Chapter 6 of this GSP.*" However, Chapter 6 of the GSP, the water budget chapter, presents very little information on the model. No further information in the GSP was presented providing description of the location of groundwater wells or stream gauges used in the analysis, or description of temporal (seasonal and interannual) variability of the data used to calibrate the model.

The GSP states (p. 4-29): *"The blue cells [in Figure 4-14] indicate areas where surface water is connected to groundwater for more than 50 percent of the number of months in the model period and are designated as areas of ISW. The clear cells represent areas that have interconnection less than 50 percent of the model period and require further evaluation to determine whether the SMC, discussed in Chapter 8, apply."* Note the regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

RECOMMENDATIONS

- Describe available groundwater elevation data and stream flow data in the subbasin. ISWs are best analyzed using depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought), to determine the range of depth and capture the variability in environmental conditions inherent in California's climate.
- Overlay the stream reaches shown on Figure 4-14 with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells in the subbasin used to create the contour maps.
- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.
- On Figure 4-14 (Locations of Interconnected Surface Water), consider any modelled stream grid cells with >0% connection to groundwater as potential ISWs until more data is available. In other words, consider any stream cell with connection to groundwater for any length of time as a potential ISW.
- Describe data gaps for the ISW analysis. Reconcile these data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of comprehensive, systematic analysis of the subbasin's GDEs.

The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources. The GSP does not discuss how the NC dataset was verified with the use of groundwater data, however. The GSP states (p.

4-33): *"The SVBGSA reviewed the NCCAG dataset and assessed each GDE's potential connection to groundwater by determining if the GDE was underlain by shallow groundwater that has been delineated as being part of a Bulletin 118 principal aquifer, and if depth to groundwater is less than 30 feet."* However, no further details are provided in the GSP. Based on the description provided in the GSP, it is unclear if Figure 4-15 (Potential Groundwater Dependent Ecosystems using NCCAG dataset) presents the entire NC dataset, or further analysis based on the 30 feet threshold as described in the text. Without an analysis of groundwater data to verify the NC dataset polygons, it will be difficult or impossible to adequately monitor and manage the subbasin's GDEs throughout GSP implementation.

We commend the GSA for listing the threatened and endangered species likely to depend on groundwater, as determined from several sources including the US Fish and Wildlife Service (USFWS) website, California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDB), and TNC Critical Species LookBook (Table 4-1). Vegetation species present in the subbasin's potential GDEs were not included in the GSP, however.

RECOMMENDATIONS

- Develop and describe a systematic approach for analyzing the subbasin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained, removed, or added to/from the NC dataset (include the removal reason if polygons are not considered potential GDEs, or include the data source if polygons are added). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as valley oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.
- Please provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin (see Attachment C of this letter for a list of freshwater species located in the Forebay Subbasin).

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included in the water budget. The integration of native vegetation into the water budget is **insufficient**. The water budget includes a separate item for evapotranspiration, but based on the text it is unclear whether the values shown in the budget tables apply to riparian evapotranspiration only or contain crop evapotranspiration as well. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. The GSP states that managed wetlands are not present in the subbasin.

RECOMMENDATION

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **incomplete**. SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the Communications and Public Engagement Plan (Chapter 2).

The GSA's outreach activities include conducting interviews with DAC community leaders to identify strategies to work together during GSP planning and implementation; conducting workshops with partners on water and groundwater sustainability; identifying concerns from DACs and underrepresented communities; planning listening sessions around GSA milestones; developing a resource hub with partner organizations; identifying community allies to partner with in reducing barriers to participation from DACs; and planning to convene a working group on

[1] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]
[2] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]
[3] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

domestic water that includes DACs and underrepresented communities. However, there is no specific pathway for feedback from DAC residents and representatives to be considered and included in the GSP and its implementation.

We note additional deficiencies with the overall stakeholder engagement process. While environmental organizations have a representative serving on the board of directors and are listed as stakeholders and as members of the GSP Advisory Committee, there is no specific outreach described that is directly targeted to environmental stakeholders during the GSP development and implementation processes.

RECOMMENDATIONS

- In the Communication and Public Engagement Plan, describe active and targeted outreach to engage environmental stakeholders during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- DAC and environmental stakeholder engagement should be improved by incorporating feedback and recommendations from DAC and environmental stakeholders engaged in the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[4] and establishing minimum thresholds.[5,6]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP discusses minimum thresholds impact on domestic wells (Section 8.6.2.2). The GSP states (p. 8-15): *"In the Forebay Subbasin, 100% of all domestic wells will have at least 25 feet of water in them as long as groundwater elevations remain above minimum thresholds; and 100% of all domestic wells will have at least 25 feet of water in them when measurable objectives are achieved."* However, the analysis was only based on 8 wells out of the total 154 domestic wells in the OSWCR database. Futhermore, the GSP states (p. 8-15): *"Some domestic wells may draw water from shallow, perched groundwater that is not managed in this GSP."* The GSP states (p. 5-13): *"The Forebay Subbasin has a single principal aquifer—the Basin Fill Aquifer."* The shallow perched zones are part of the single aquifer system and are still governed by the requirements of SGMA.

[4] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
[5] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[6] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Section 8.6.4 defines undesirable results for the chronic lowering of groundwater level SMC. The GSP states (p. 8-22): *"The chronic lowering of groundwater levels undesirable result is: more than 15% of the groundwater elevation minimum thresholds are exceeded."* However, undesirable results should inform the development of minimum thresholds, not the other way around. The GSP should establish minimum thresholds at the representative monitoring wells that account for the specific undesirable results the GSA has determined for the subbasin. The current analysis, which only considers 8 out of 154 wells, is insufficient and does not use best available information, for example including Public Land Survey System (PLSS) section location data, as was used in the 180/400 Foot Aquifer GSP.

For degraded water quality, the GSP identifies constituents of concern (COCs) within the subbasin. The GSP states (p. 5-19): *"The SVBGSA does not have regulatory authority over groundwater quality and is not charged with improving groundwater quality in the Salinas Valley Groundwater Basin."* Table 8-5 provides a list of constituents and number of wells that must exceed regulatory standards in order to trigger minimum thresholds but fails to provide justification for how those numbers were selected. The GSP also sets measurable objectives identical to minimum thresholds; the exceedance of minimum thresholds is supposed to trigger additional actions but since minimum thresholds in this plan are identified as measurable objectives, it is unclear what action is triggered. Furthermore, the regulatory standards are not explicitly provided in the GSP.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for chronic lowering of groundwater levels. For the analysis of minimum threshold impact on domestic wells, use best available information such as Public Land Survey System (PLSS) section location data.

- Establish minimum thresholds at the representative monitoring wells that account for the specific undesirable results the GSA would like to avoid.

Degraded Water Quality

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[7]

- Set measurable objectives at lower levels than minimum thresholds (i.e., indicative of better water quality).

- Set concentration-based minimum thresholds and measurable objectives for COCs in the subbasin that are impacted by groundwater use and/or management. Ensure they align with drinking water standards[8].

[7] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[8] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts to GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC.

Sustainable management criteria for depletion of interconnected surface water are established by proxy using shallow groundwater elevations observed in December 2015 near locations of interconnected surface water. To describe impacts to ecological surface water users, the GSP states (p. 8-45): "*Review of MCWRA's Nacimiento Dam Operation Policy and MCWRA's water rights indicates MCWRA operates the Dam in a manner that meets downstream demands and considers ecological surface water users. Since the reservoir operations consider ecological surface water users and reflect reasonable existing surface water depletion rates, this GSP infers that stream depletion from existing groundwater pumping is not unreasonable*." The GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[9] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[10] can be determined.

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached[11]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users

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[9] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[10] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[11] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,12].

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[13] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the GSP does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

We acknowledge and commend the inclusion of climate change into key inputs (e.g., precipitation, evapotranspiration, surface water flow, and sea level) of the projected water budget. However, the GSP does not calculate a sustainable yield based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

[12] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[13] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent shallow groundwater elevations and water quality conditions around DACs and domestic wells in the subbasin.

Figure 7-1 (Forebay Aquifer Monitoring Network for Groundwater Levels) and Figure 7-4 (Locations of DDW Public Water System Supply Wells in the Groundwater Quality Monitoring Network) show that no monitoring wells are located across portions of the subbasin near DACs and domestic wells. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[14].

The GSP provides discussion of data gaps for GDEs and ISWs in Section 7.6 (Interconnected Surface Water Monitoring Network) of the GSP. The GSP could be improved by describing biological monitoring that could be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

RECOMMENDATIONS

- Provide maps that overlay monitoring well locations with the locations of DACs and domestic wells to clearly identify potentially impacted areas. Increase the number of representative monitoring sites (RMSs) in the shallow aquifer across the subbasin for the groundwater elevation and groundwater quality condition indicators. Prioritize proximity to DACs and drinking water users when identifying new RMSs.

- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

- Ensure groundwater elevation and water quality RMSs are tracking groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, GDEs, and ISWs. Groundwater elevation and quality RMS data gaps (spatial and depth) in relation to key beneficial users in the subbasin are provided in Attachment E.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

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[14] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

In Section 9.6.3 (Implementation Action C3: Dry Well Notification System), the GSP states (p. 9-37): "*The GSA could develop or support the development of a program to assist well owners (domestic or state small and local small water systems) whose wells go dry due to declining groundwater elevations."* The GSP states that the program could involve a notification system, monitoring triggered by lowered groundwater elevations, public outreach, *"...referral to assistance with short-term supply solutions, technical assistance to assess why it went dry, and/or long-term supply solutions.*" No further specifics on a drinking water well impact mitigation program are provided, however.

RECOMMENDATIONS

- For DACs and domestic well owners, provide specific plans for implementation of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[15].

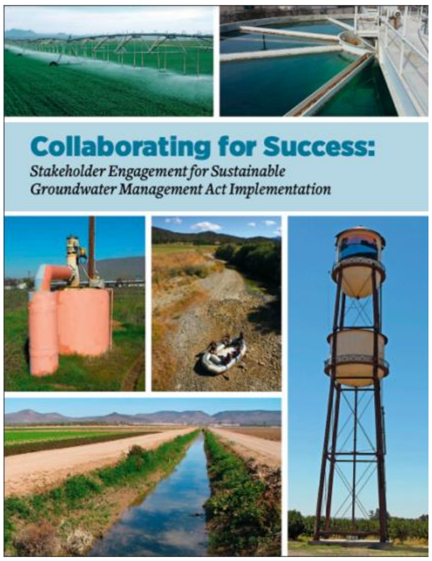
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[15] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

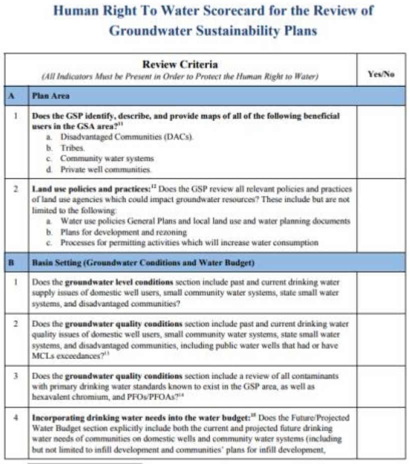
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

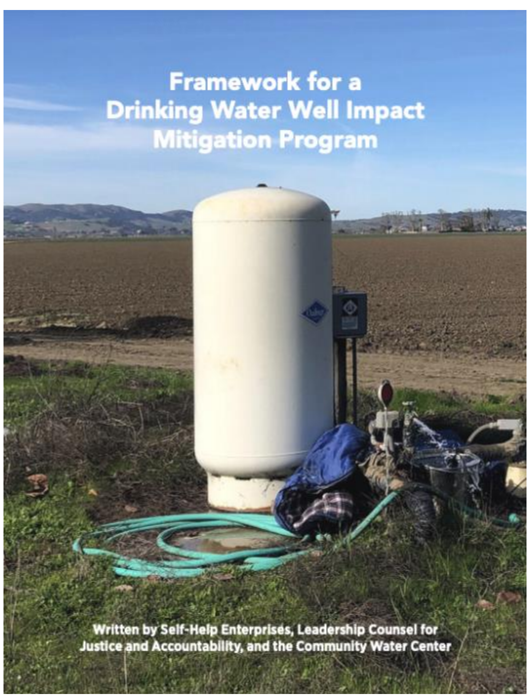


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

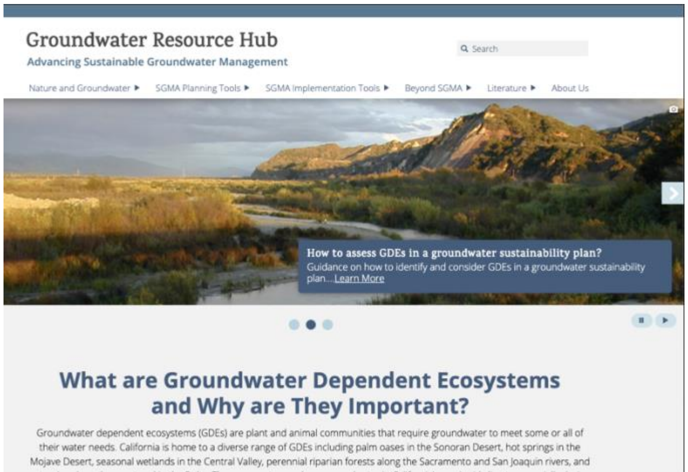
The [Human Right to Water Scorecard](#) was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



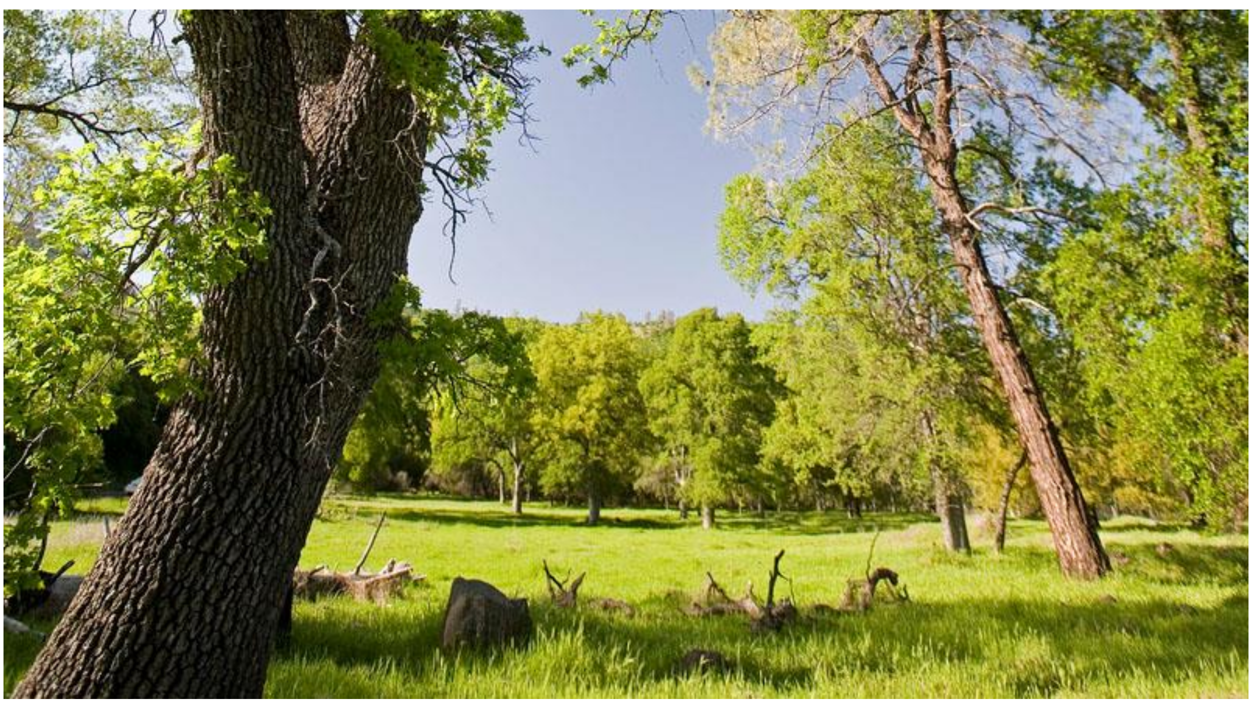
The [Drinking Water Well Impact Mitigation Framework](#) was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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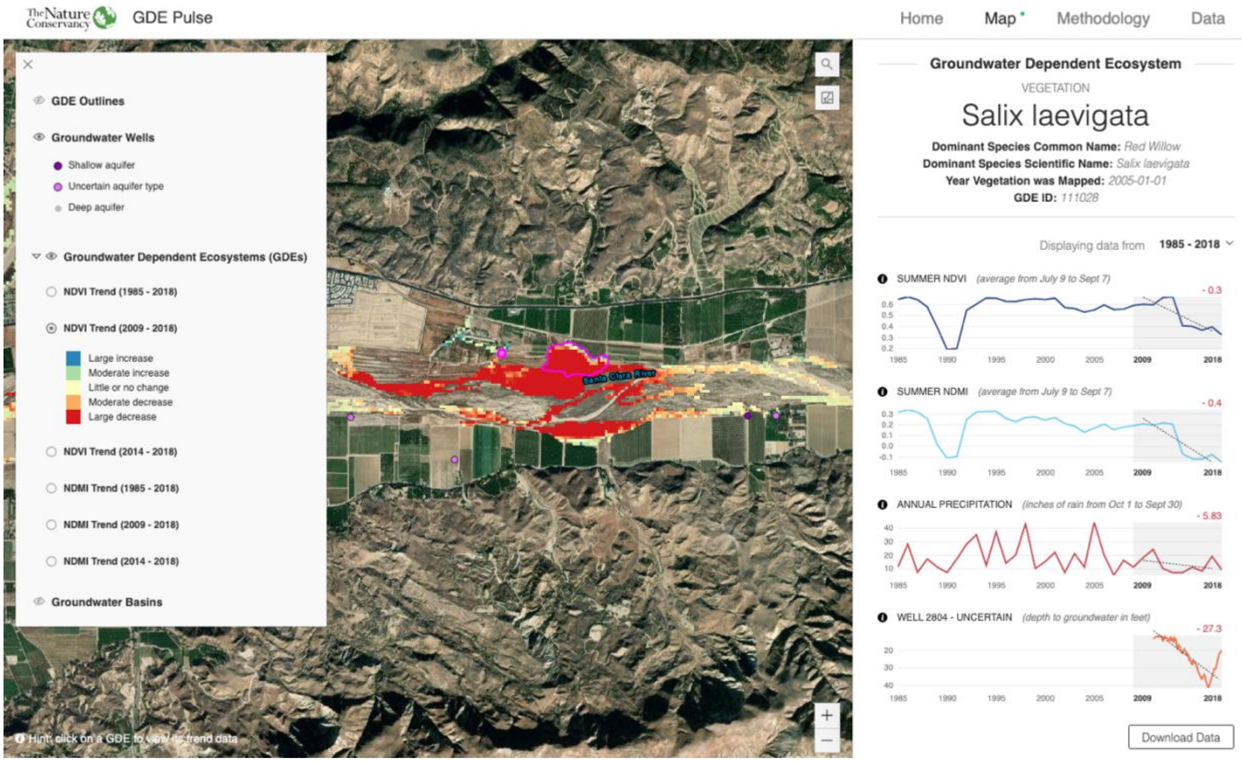
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](https://) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

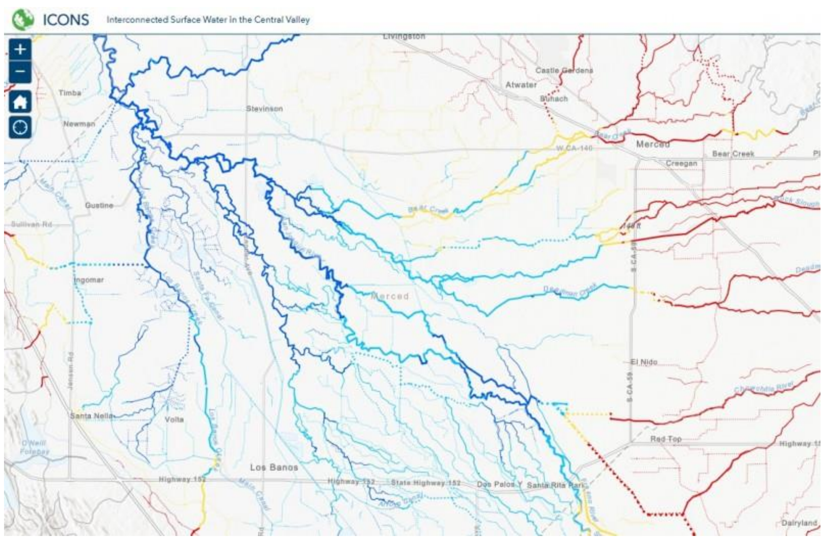
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Forebay Aquifer Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Forebay Aquifer Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Aix sponsa	Wood Duck			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Ardea herodias	Great Blue Heron			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Riparia riparia	Bank Swallow		Threatened	
Tringa melanoleuca	Greater Yellowlegs			
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Cyprididae fam.	Cyprididae fam.			
Hyalella spp.	Hyalella spp.			
Pacifastacus leniusculus leniusculus	Signal Crayfish			
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus mykiss - SCCC	South Central California coast steelhead	Threatened	Special Concern	Vulnerable - Moyle 2013

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[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus boreas halophilus	California Toad			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis infernalis	California Red-sided Gartersnake			Not on any status lists
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Optioservus canus	Pinnacles Optioservus Riffle Beetle		Special	
Acentrella insignificans	A Mayfly			
Acentrella spp.	Acentrella spp.			
Acentrella turbida	A Mayfly			
Agabus spp.	Agabus spp.			
Agapetus spp.	Agapetus spp.			
Ambrysus mormon				Not on any status lists
Anax walsinghami	Giant Green Darner			
Antocha spp.	Antocha spp.			
Argia spp.	Argia spp.			
Baetidae fam.	Baetidae fam.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Berosus spp.	Berosus spp.			
Callibaetis spp.	Callibaetis spp.			
Centroptilum spp.	Centroptilum spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			

Chloroperlidae fam.	Chloroperlidae fam.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Cricotopus trifascia				Not on any status lists
Cryptochironomus spp.	Cryptochironomus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Drunella spp.	Drunella spp.			
Epeorus spp.	Epeorus spp.			
Ephemerella spp.	Ephemerella spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Ephydridae fam.	Ephydridae fam.			
Fallceon quilleri	A Mayfly			
Gumaga spp.	Gumaga spp.			
Gyrinus spp.	Gyrinus spp.			
Helichus spp.	Helichus spp.			
Helicopsyche spp.	Helicopsyche spp.			
Heptageniidae fam.	Heptageniidae fam.			
Hydrophilidae fam.	Hydrophilidae fam.			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Hydryphantidae fam.	Hydryphantidae fam.			
Ischnura spp.	Ischnura spp.			
Isoperla spp.	Isoperla spp.			
Leptoceridae fam.	Leptoceridae fam.			
Leucotrichia spp.	Leucotrichia spp.			
Liodessus spp.	Liodessus spp.			
Malenka spp.	Malenka spp.			
Micrasema spp.	Micrasema spp.			
Microcylloepus spp.	Microcylloepus spp.			
Micropsectra spp.	Micropsectra spp.			
Microtendipes spp.	Microtendipes spp.			
Mystacides alafimbriatus	A Caddisfly			
Nectopsyche spp.	Nectopsyche spp.			
Ochrotrichia spp.	Ochrotrichia spp.			
Optioservus spp.	Optioservus spp.			
Ordobrevia nubifera				Not on any status lists
Oxyethira spp.	Oxyethira spp.			
Paracladopelma spp.	Paracladopelma spp.			
Paracymus spp.	Paracymus spp.			
Parakiefferiella spp.	Parakiefferiella spp.			

Paratanytarsus spp.	Paratanytarsus spp.			
Peltodytes spp.	Peltodytes spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Progomphus borealis	Gray Sanddragon			
Psectrocladius spp.	Psectrocladius spp.			
Psephenus falli				Not on any status lists
Rheotanytarsus spp.	Rheotanytarsus spp.			
Serratella spp.	Serratella spp.			
Sigara mckinstryi	A Water Boatman			Not on any status lists
Sigara spp.	Sigara spp.			
Simuliidae fam.	Simuliidae fam.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sperchontidae fam.	Sperchontidae fam.			
Stictotarsus striatellus				Not on any status lists
Tanytarsus spp.	Tanytarsus spp.			
Telebasis salva	Desert Firetail			
Tinodes spp.	Tinodes spp.			
Tipulidae fam.	Tipulidae fam.			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus spp.	Tropisternus spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
MOLLUSKS				
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			
PLANTS				
Arundo donax	NA			
Eleocharis acicularis acicularis	Least Spikerush			
Euthamia occidentalis	Western Fragrant Goldenrod			
Juncus luciensis	Santa Lucia Dwarf Rush		Special	CRPR - 1B.2
Persicaria maculosa	NA			Not on any status lists
Rorippa palustris palustris	Bog Yellowcress			
Veronica americana	American Speedwell			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

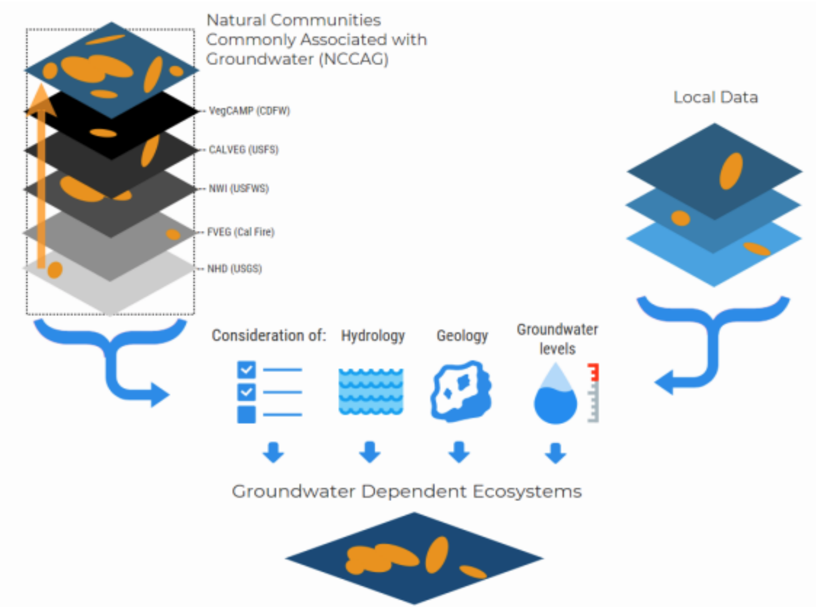

Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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3 For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
4 "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
5 The Groundwater Resource Hub: www.GroundwaterResourceHub.org

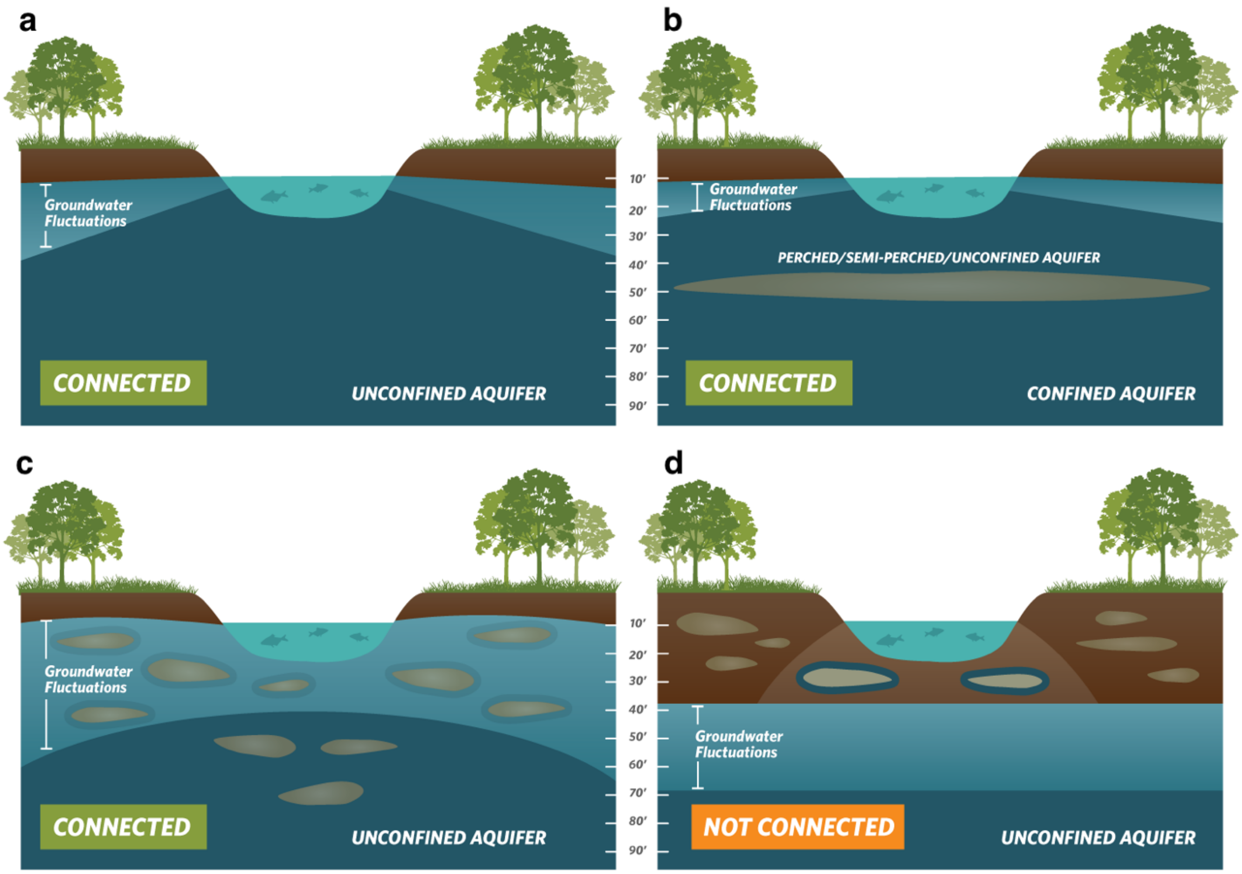

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

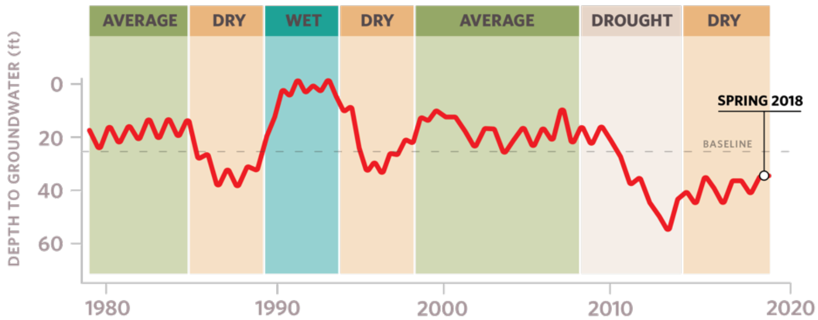

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

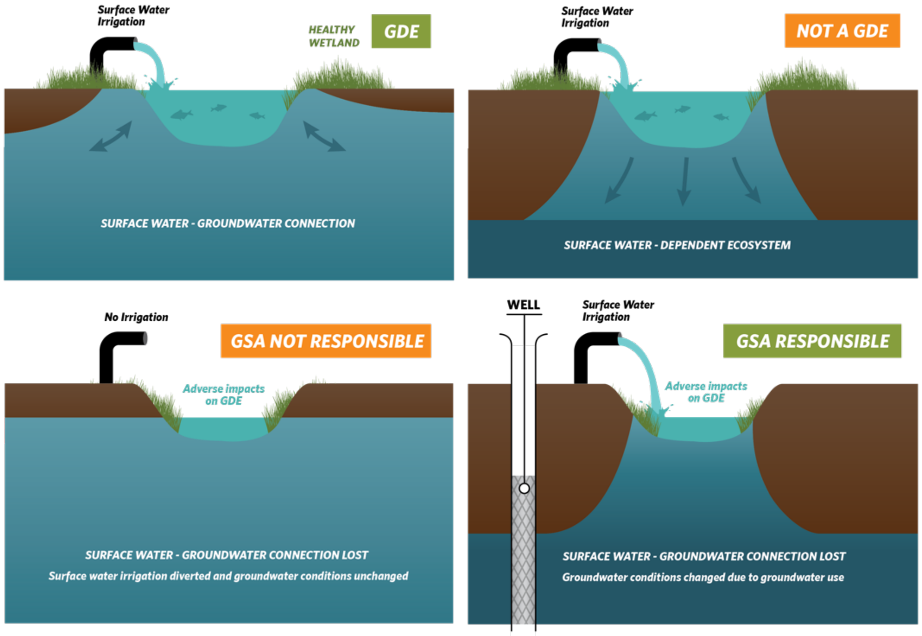

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

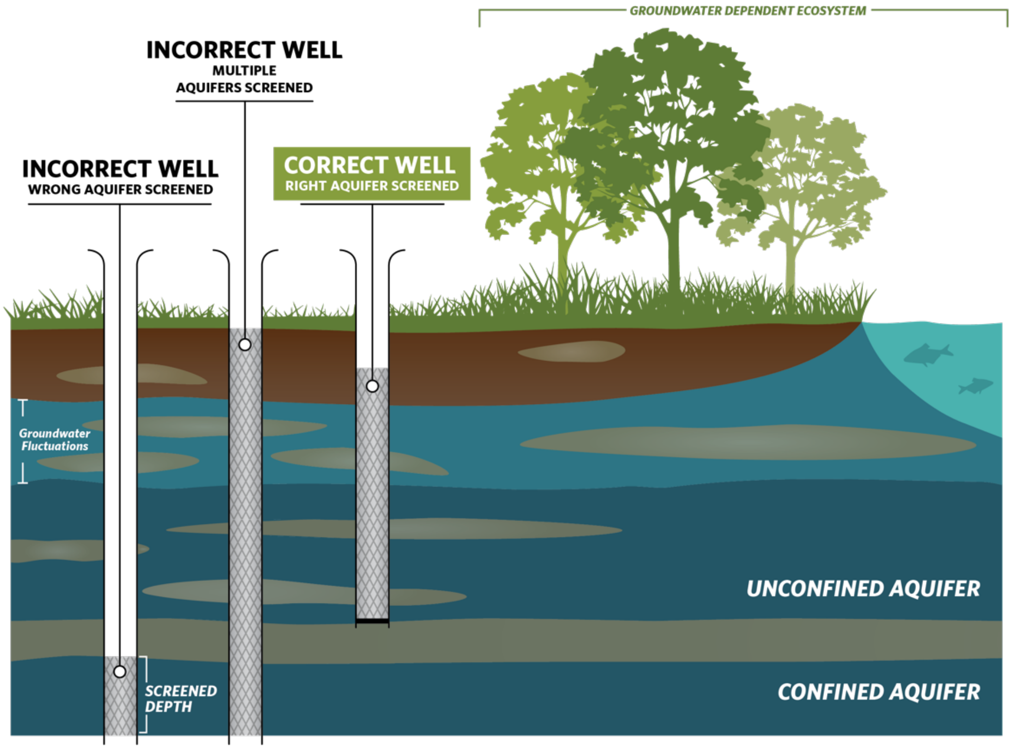

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

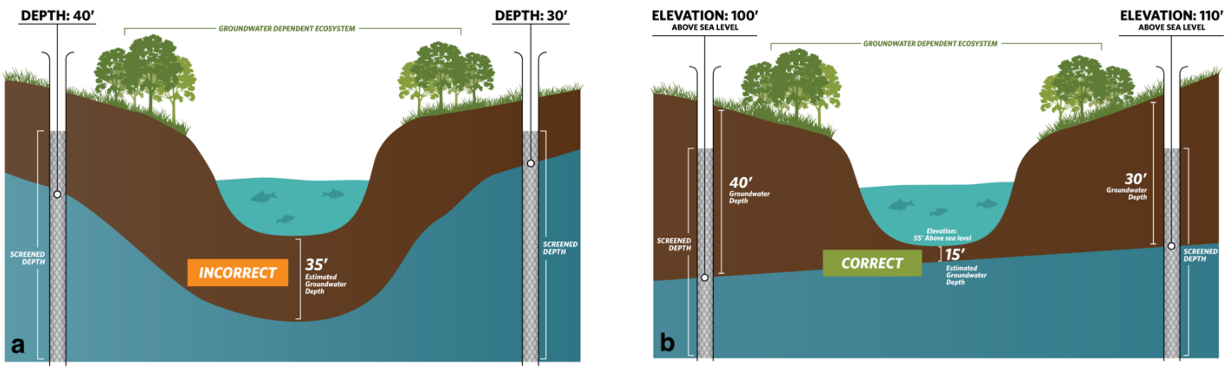

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

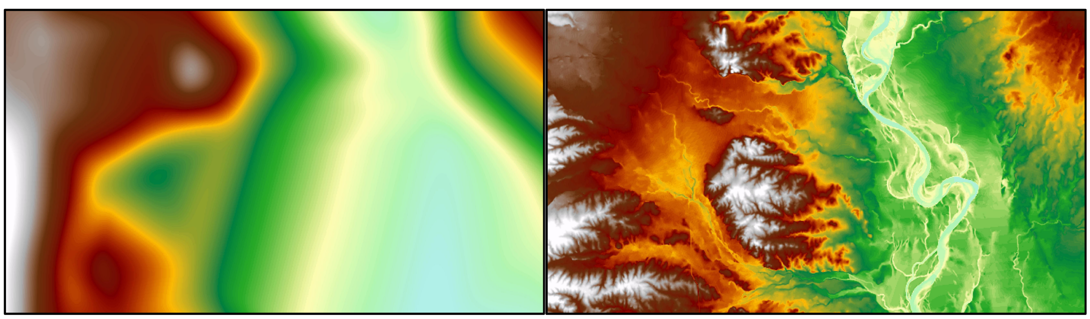

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

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[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

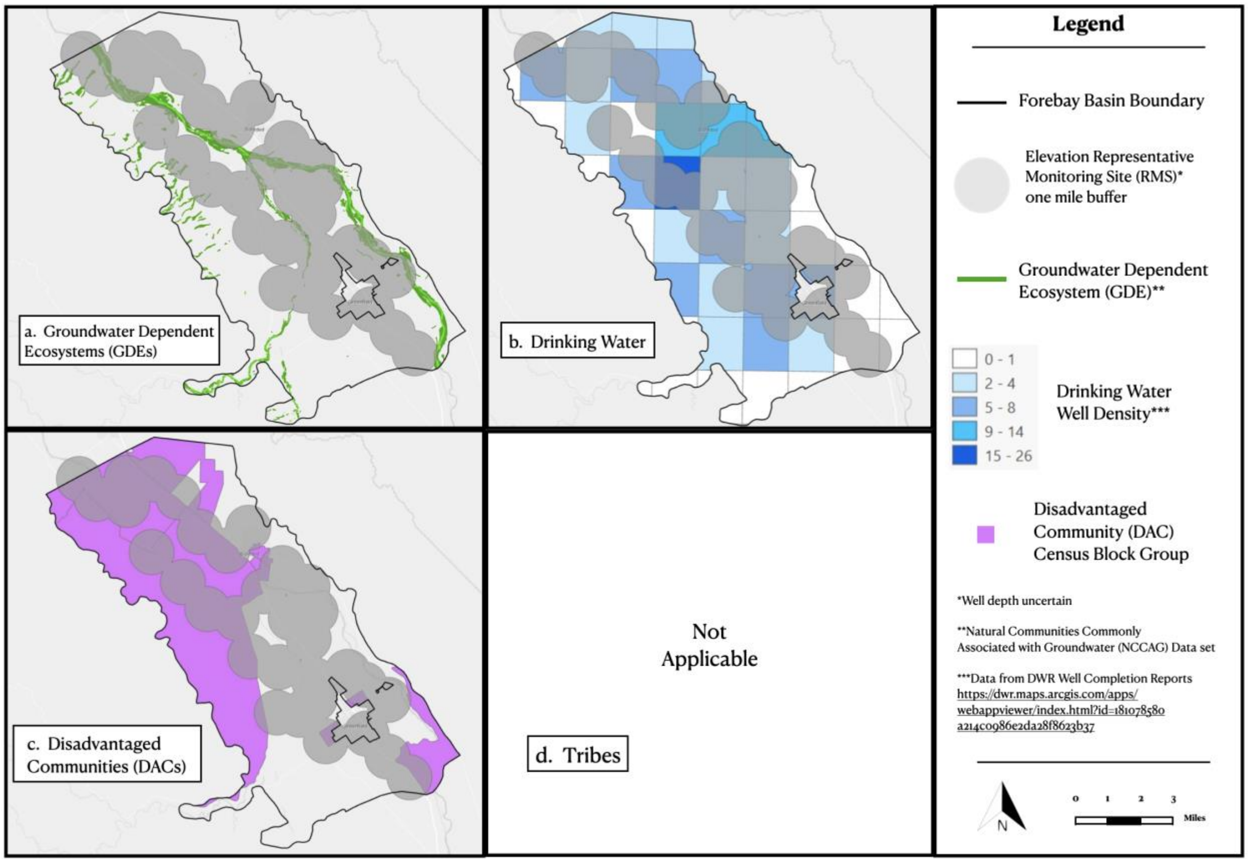

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

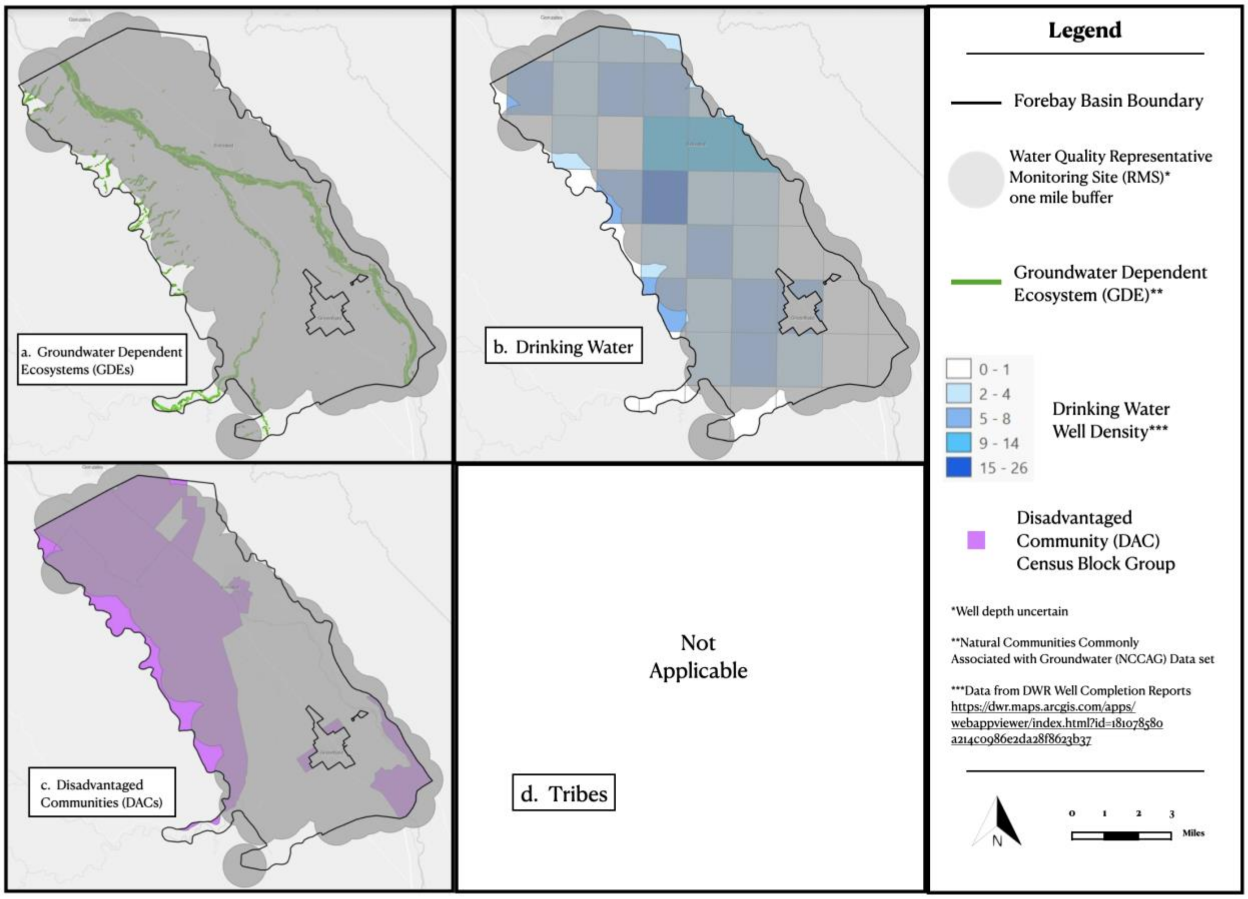

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

October 15, 2021

Salinas Valley Basin GSA
P.O. Box 1350
Carmel Valley, CA 93924

Submitted via web: https://form.jotform.com/201537036733047

Re: Public Comment Letter for the Langley Aquifer Subbasin Draft GSP

Dear Donna Meyers,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Langley Aquifer Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Langley Aquifer Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Heather Lukacs, Ph.D.
Director of Community Solutions
Community Water Center

Justine Massey
Policy Manager and Attorney
Community Water Center

Attachment A

Specific Comments on the Langley Aquifer Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP provides information on DACs, including identification by name and location on a map (Figure 2-3), and identifying the water source for DAC members. However, the GSP fails to identify the population of each identified DAC.

The GSP provides a density map of domestic wells in the subbasin. However, the GSP fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS
• Include a map showing domestic well locations and average well depth across the subbasin. • Provide the population of each identified DAC.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **insufficient**, due to lack of supporting information provided for the ISW analysis. To assess ISWs, the GSP used the Salinas Valley Integrated Hydrologic Model (SVIHM). The GSP states (p. 4-22): *"Although seepage along the ISW reaches is based on assumed channel and aquifer parameters as model inputs, the preliminary SVIHM is the best available tool to estimate ISW locations. The model construction and uncertainty are described in Chapter 6 of this GSP."* However, Chapter 6 of the GSP, the water budget chapter, presents very little information on the model. No further information in the GSP was presented providing description of the location of groundwater wells or stream gauges used in the analysis, or description of temporal (seasonal and interannual) variability of the data used to calibrate the model.

The GSP states (p. 4-22): *"The blue cells [in Figure 4-9] indicate areas where surface water is connected to groundwater for more than 50 percent of the number of months in the model period and are designated as areas of ISW. The clear cells represent areas that have interconnection less than 50 percent of the model period and require further evaluation to determine whether the SMC, discussed in Chapter 8, apply.*" Note the regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. The GSP states (p. 4-22): "Interconnection between surface water and groundwater can vary both in time and space. A seasonal analysis is included in Appendix 4A." The appendix was not included in the public draft copy of the GSP, however.

RECOMMENDATIONS

- Describe available groundwater elevation data and stream flow data in the subbasin. ISWs are best analyzed using depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought), to determine the range of depth and capture the variability in environmental conditions inherent in California's climate.

- Overlay the stream reaches shown on Figure 4-9 with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells in the subbasin used to create the contour maps.

- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

- On Figure 4-9 (Locations of Interconnected Surface Water), consider any modelled stream grid cells with >0% connection to groundwater as potential ISWs until more data is available. In other words, consider any stream cell with connection to groundwater for any length of time as a potential ISW.

- Describe data gaps for the ISW analysis. Reconcile these data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of comprehensive, systematic analysis of the subbasin's GDEs.

The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources. The GSP does not discuss how the NC dataset was verified with the use of groundwater data, however. The GSP states (p. 4-26): "*The SVBGSA reviewed the NCCAG dataset and assessed each GDE's potential* *connection to groundwater by determining if the GDE was underlain by shallow groundwater that has been delineated as being part of a Bulletin 118 principal aquifer, and if depth to groundwater is less than 30 feet."* However, no further details are provided in the GSP. Based on the description provided in the GSP, it is unclear if Figure 4-10 (Groundwater Dependent Ecosystems) presents the entire NC dataset, or further analysis based on the 30 feet threshold as described in the text. Without an analysis of groundwater data to verify the NC dataset polygons, it will be difficult or impossible to adequately monitor and manage the subbasin's GDEs throughout GSP implementation.

We commend the GSA for listing the threatened and endangered species likely to depend on groundwater, as determined from several sources including the US Fish and Wildlife Service (USFWS) website, California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDB), and TNC Critical Species LookBook (Table 4-1). Vegetation species present in the subbasin's potential GDEs were not included in the GSP, however.

RECOMMENDATIONS

- Develop and describe a systematic approach for analyzing the subbasin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained, removed, or added to/from the NC dataset (include the removal reason if polygons are not considered potential GDEs, or include the data source if polygons are added). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as valley oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as “Potential GDEs” in the GSP until data gaps are reconciled in the monitoring network.
- Please provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin (see Attachment C of this letter for a list of freshwater species located in the Langley Subbasin).

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included in the water budget. The integration of native vegetation into the water budget is **insufficient**. The water budget includes a separate item for evapotranspiration, but based on the text it is unclear whether the values shown in the budget tables apply to riparian evapotranspiration only or contain crop evapotranspiration as well. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. The GSP states that managed wetlands are not present in the subbasin.

RECOMMENDATION

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **incomplete**. SGMA’s requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the Communication and Public Engagement section of the GSP (Chapter 2).

The GSA’s outreach activities include conducting interviews with DAC community leaders to identify strategies to work together during GSP planning and implementation; conducting workshops with partners on water and groundwater sustainability; identifying concerns from DACs and underrepresented communities; planning listening sessions around GSA milestones; developing a resource hub with partner organizations; identifying community allies to partner with

[1] “’Water use sector’ refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation.” [23 CCR §351(al)]

[2] “The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.” [23 CCR §354.18]

[3] “A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin.” [23 CCR §354.10(d)(3)]

in reducing barriers to participation from DACs; and planning to convene a working group on domestic water that includes DACs and underrepresented communities. However, there is no specific pathway for feedback from DAC residents and representatives to be considered and included in the GSP and its implementation.

We note additional deficiencies with the overall stakeholder engagement process. While environmental organizations have a representative serving on the board of directors and are listed as stakeholders and as members of the GSP Advisory Committee, there is no specific outreach described that is directly targeted to environmental stakeholders during the GSP development and implementation processes.

RECOMMENDATIONS

- In the Communication and Public Engagement Plan, describe active and targeted outreach to engage environmental stakeholders during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.
- DAC and environmental stakeholder engagement should be improved by incorporating feedback and recommendations from DAC and environmental stakeholders engaged in the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[4] and establishing minimum thresholds.[5,6]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP discusses minimum thresholds impact on domestic wells (Section 8.6.2.2). The GSP states (p. 8-14): *"In the Langley Subbasin, 85% of the domestic wells will have at least 25 feet of water in them as long as groundwater elevations remain above minimum thresholds and measurable objectives. These percentages were considered reasonable despite the limitations of this analysis."* The GSP states (p. 8-8): *"The minimum thresholds for chronic lowering of groundwater levels are set to 2019 groundwater elevations, adjusted based on well-specific elevation assessments."* The GSP does not explain the rationale behind using 2019 groundwater elevation data instead of data from the period before the SGMA benchmark date of 2015.

[4] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
[5] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[6] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Section 8.6.4 defines undesirable results for the chronic lowering of groundwater level SMC. The GSP states (p. 8-20): *"The chronic lowering of groundwater levels undesirable result is: more than 15% of the groundwater elevation minimum thresholds are exceeded."* However, undesirable results should inform the development of minimum thresholds, not the other way around. The GSP should establish minimum thresholds at the representative monitoring wells that account for the specific undesirable results the GSA has determined for the subbasin. The current analysis, which only considers 41 out of 823 wells, is insufficient and does not use best available information, for example including Public Land Survey System (PLSS) section location data, as was used in the 180/400 Foot Aquifer GSP.

For degraded water quality, the GSP identifies constituents of concern (COCs) within the subbasin. The GSP states (p. 5-21): *"The SVBGSA does not have regulatory authority over groundwater quality and is not charged with improving groundwater quality in the Salinas Valley Groundwater Basin."* Table 8-4 provides a list of constituents and number of wells that must exceed regulatory standards in order to trigger minimum thresholds but fails to provide justification for how those numbers were selected. The GSP also sets measurable objectives identical to minimum thresholds; the exceedance of minimum thresholds is supposed to trigger additional actions but since minimum thresholds in this plan are identified as measurable objectives, it is unclear what action is triggered. Furthermore, the regulatory standards are not explicitly provided in the GSP.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for chronic lowering of groundwater levels. For the analysis of minimum threshold impact on domestic wells, use best available information such as Public Land Survey System (PLSS) section location data.

- Establish minimum thresholds at the representative monitoring wells that account for the specific undesirable results the GSA would like to avoid. Use groundwater level data from the period before the SGMA benchmark date of 2015 for the analysis.

Degraded Water Quality

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[7]

- Set measurable objectives at lower levels than minimum thresholds (i.e., indicative of better water quality).

[7] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

- Set concentration-based minimum thresholds and measurable objectives for COCs in the subbasin that are impacted by groundwater use and/or management. Ensure they align with drinking water standards[8].
- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts to GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC.

Sustainable management criteria for depletion of interconnected surface water are established by proxy using shallow groundwater elevations observed in 2019 near locations of interconnected surface water. To describe impacts to ecological surface water users, the GSP states (p. 8-49): *"There are no known flow prescriptions on any surface water bodies in the Subbasin. Therefore, the current level of depletion has not violated any ecological flow requirements. This is not meant to imply that depletions do not impact potential species living in or near surface water bodies in the Subbasin. However, any impacts that may be occurring have not risen to the level that triggers regulatory intervention. Therefore, the impacts from current rates of depletion on ecological surface water users is not unreasonable."* The GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[9] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[10] can be determined.

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8 "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

9 "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

10 The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached[11]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,12].

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[13] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the GSP does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

We acknowledge and commend the inclusion of climate change into key inputs (e.g., precipitation, evapotranspiration, surface water flow, and sea level) of the projected water budget. However, the GSP does not calculate a sustainable yield based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

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[11] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[12] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[13] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent shallow groundwater elevations around DACs and domestic wells in the subbasin. The monitoring network that represents water quality conditions around DACs and domestic wells in the subbasin is sufficient in terms of spatial distribution but is insufficient in terms of depth representation.

Figure 7-1 (Langley Area Representative Monitoring Network for Groundwater Levels) shows that no monitoring wells are located across portions of the subbasin near DACs and domestic wells. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[14].

The GSP provides discussion of data gaps for GDEs and ISWs in Section 7.7 (Interconnected Surface Water Monitoring Network) of the GSP. The GSP could be improved by describing biological monitoring that could be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

RECOMMENDATIONS

- Provide maps that overlay monitoring well locations with the locations of DACs and domestic wells to clearly identify potentially impacted areas. Increase the number of representative monitoring sites (RMSs) in the shallow aquifer across the subbasin for the groundwater elevation and groundwater quality condition indicators. Prioritize proximity to DACs and drinking water users when identifying new RMSs.
- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.
- Ensure groundwater elevation and water quality RMSs are tracking groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, GDEs, and ISWs. Groundwater elevation and quality RMS data gaps

[14] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

(spatial and depth) in relation to key beneficial users in the subbasin are provided in Attachment E.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

The GSP states (p. 8-14): *"In the Langley Subbasin, 85% of the domestic wells will have at least 25 feet of water in them as long as groundwater elevations remain above minimum thresholds and measurable objectives."* Therefore, up to 15% of domestic wells could be impacted when water levels drop below measurable objectives, and even more could be impacted when water levels reach minimum thresholds. In Section 9.5.3 (Implementation Action D3: Dry Well Notification System), the GSP states (p. 9-46): *"The GSA could develop or support the development of a program to assist well owners (domestic or state small and local small water systems) whose wells go dry due to declining groundwater elevations."* The GSP states that the program could involve a notification system, monitoring triggered by lowered groundwater elevations, public outreach, *"...referral to assistance with short-term supply solutions, technical assistance to assess why it went dry, and/or long-term supply solutions."* No further specifics on a drinking water well impact mitigation program are provided, however.

RECOMMENDATIONS

- For DACs and domestic well owners, provide specific plans for implementation of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[15].

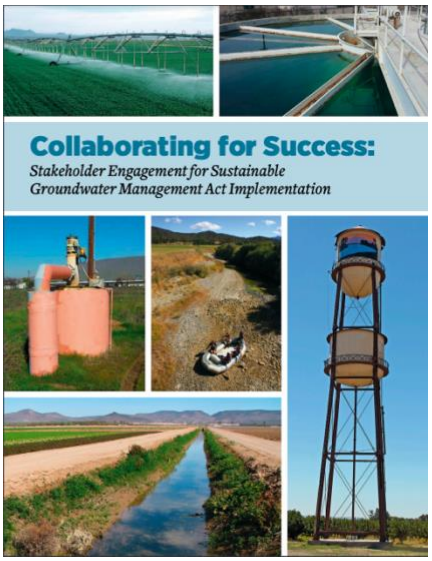
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[15] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



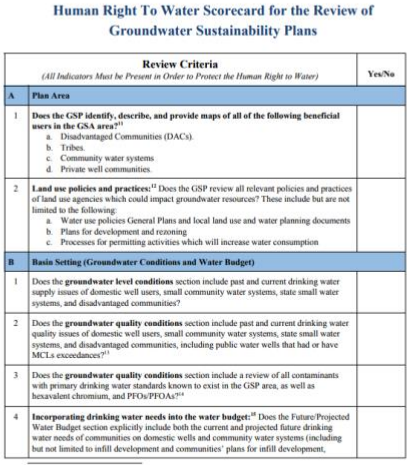
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

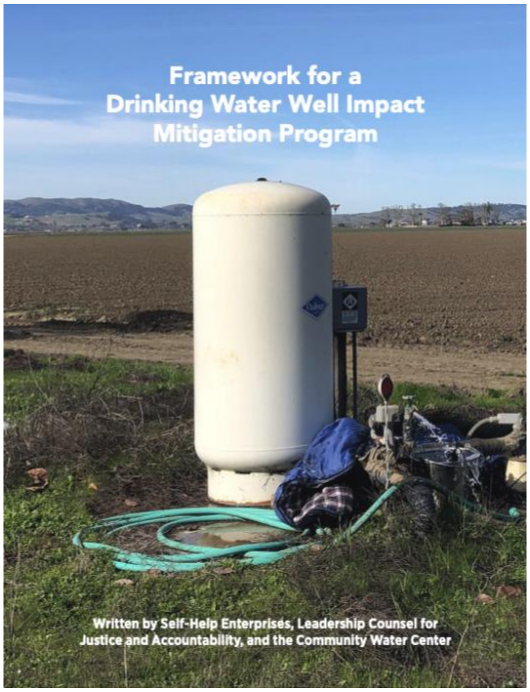


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria (All Indicators Must be Present in Order to Protect the Human Right to Water)	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

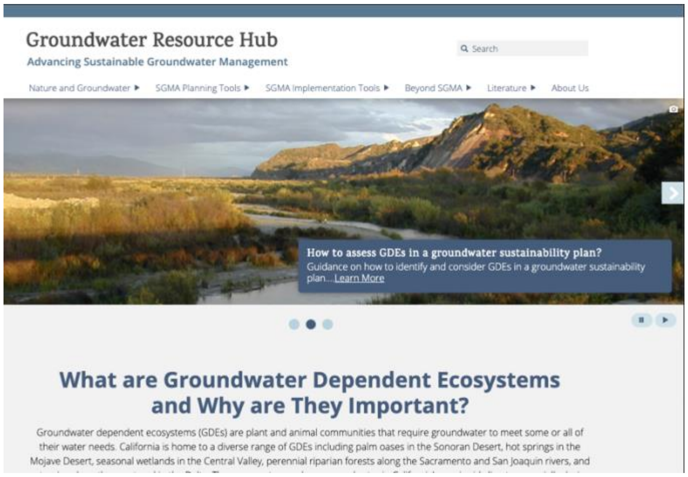
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

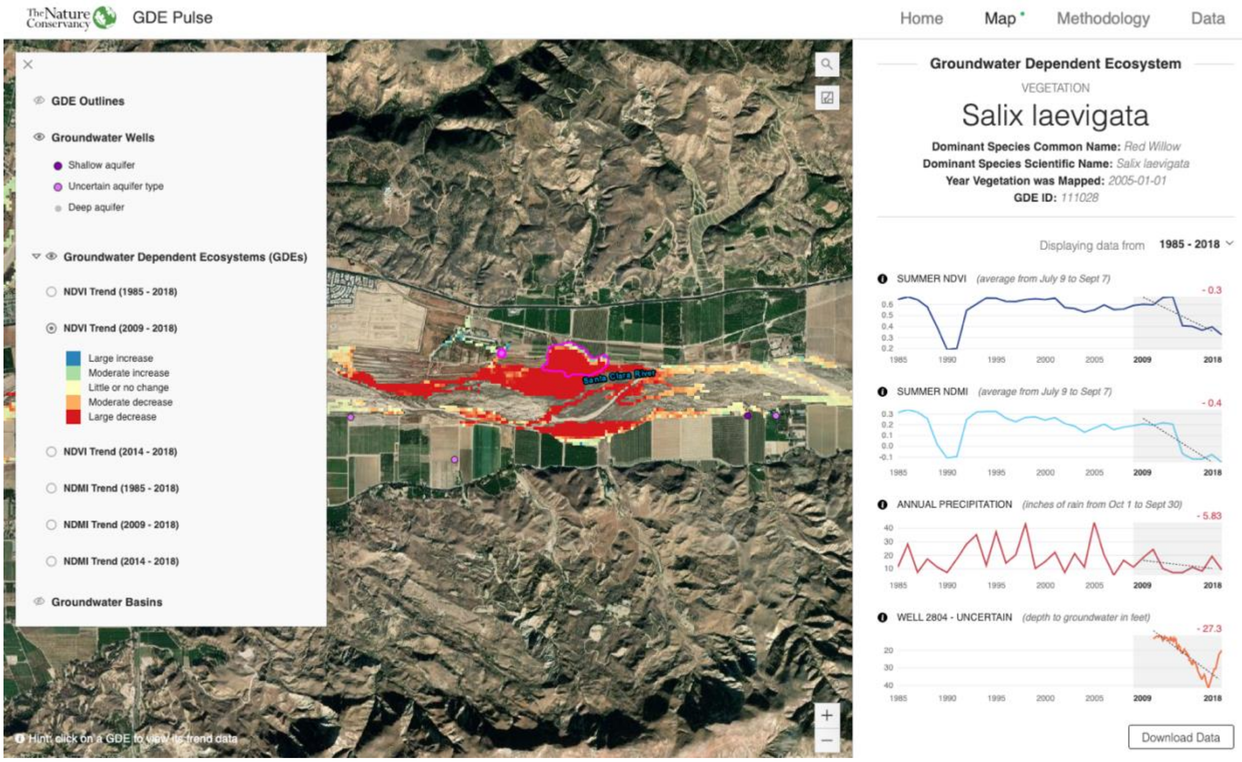
1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](https://gdepulse.org) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

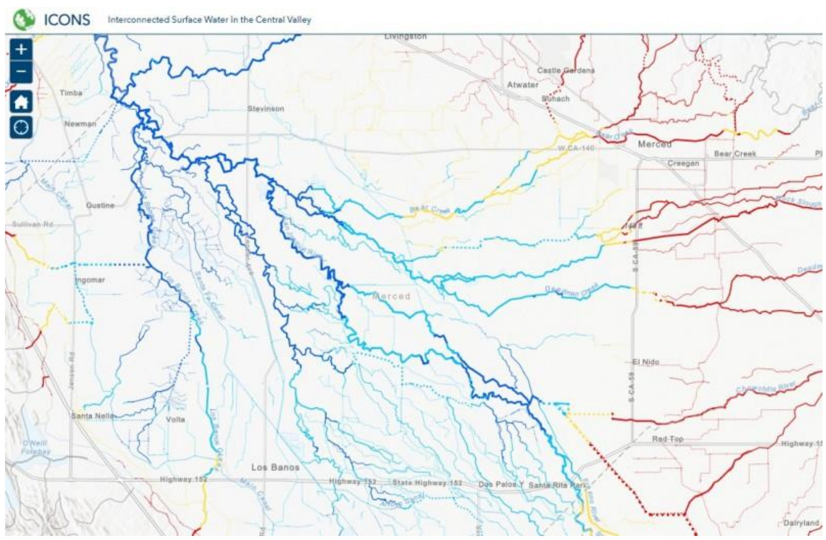
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Langley Area Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Langley Area Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya valisineria	Canvasback		Special	
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Chen caerulescens	Snow Goose			
Egretta thula	Snowy Egret			
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Phalacrocorax auritus	Double-crested Cormorant			
Podilymbus podiceps	Pied-billed Grebe			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
FISH				
Oncorhynchus mykiss - SCCC	South Central California coast steelhead	Threatened	Special Concern	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Anaxyrus boreas halophilus	California Toad			ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
INSECTS & OTHER INVERTS				
Pantala flavescens	Wandering Glider			
Plathemis lydia	Common Whitetail			
MAMMALS				
Lontra canadensis canadensis	North American River Otter			Not on any status lists
PLANTS				
Carex harfordii	Harford's Sedge			
Cotula coronopifolia	NA			
Euthamia occidentalis	Western Fragrant Goldenrod			
Hypericum anagalloides	Tinker's-penny			
Perideridia gairdneri gairdneri	Gairdner's Yampah		Special	CRPR - 4.2
Populus trichocarpa	NA			Not on any status lists
Psilocarphus tenellus	NA			

Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

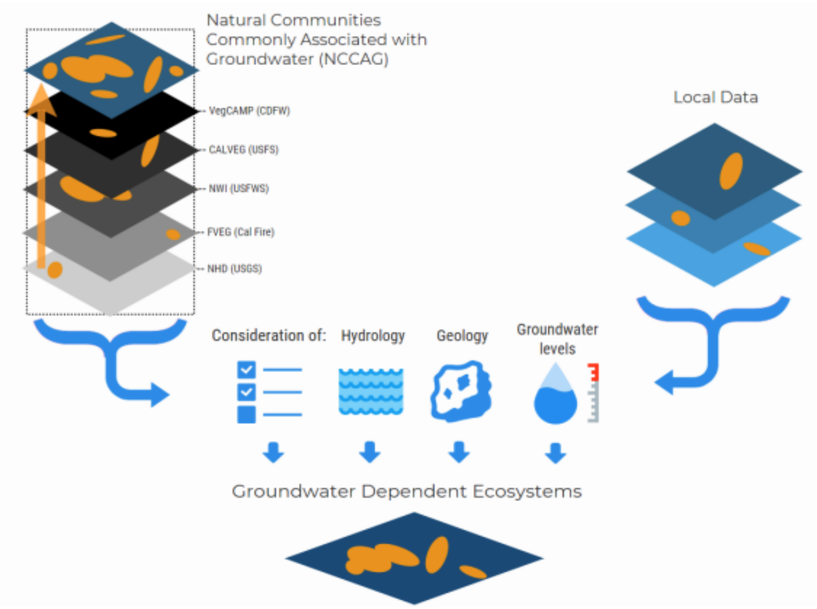


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

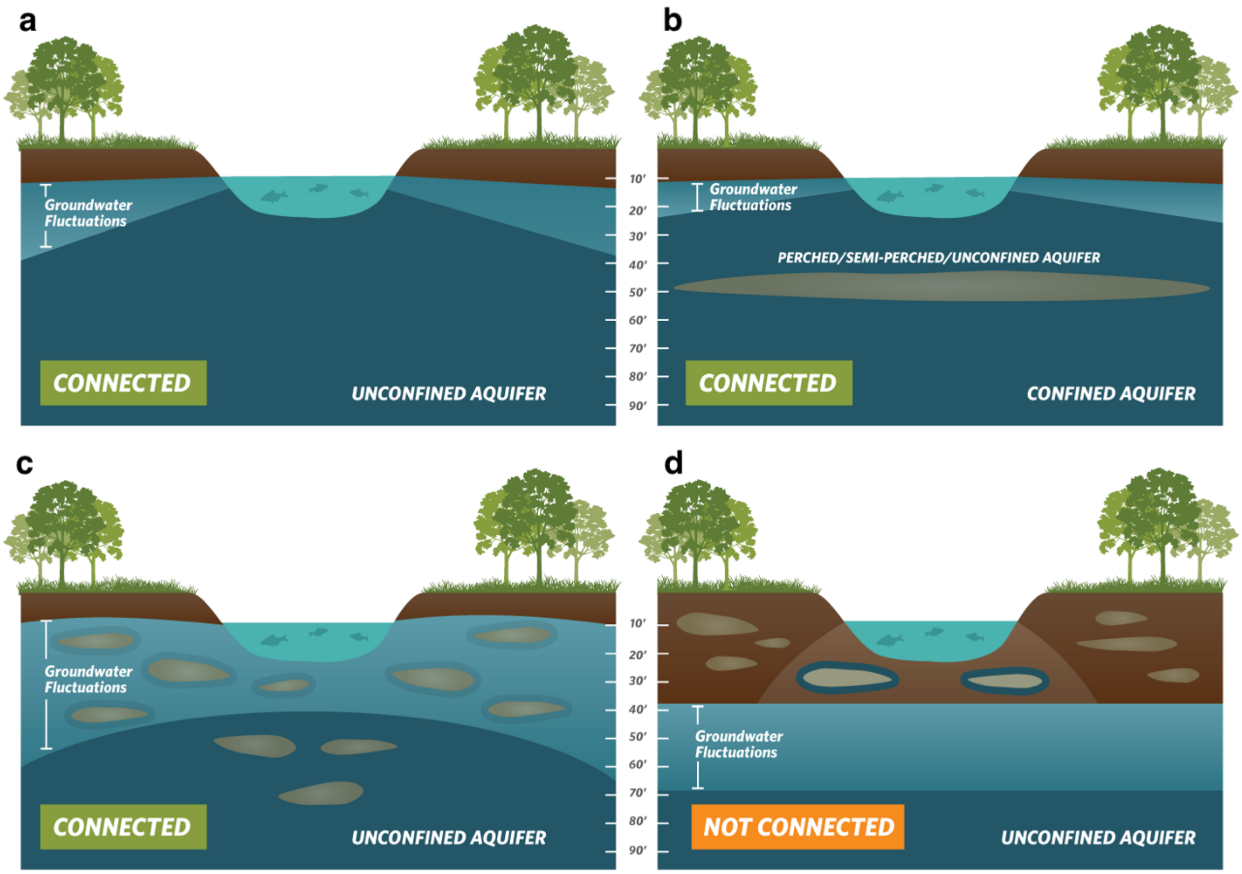


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

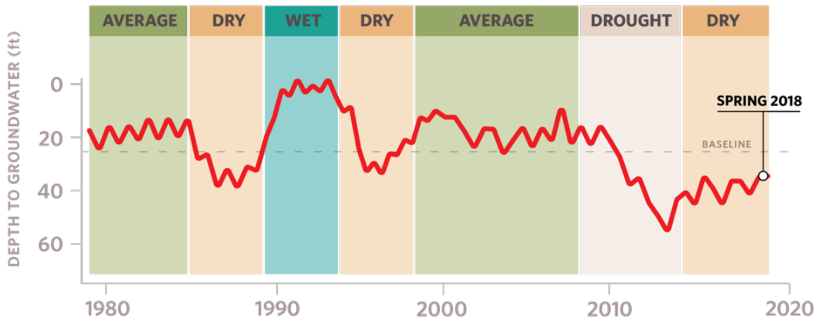


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

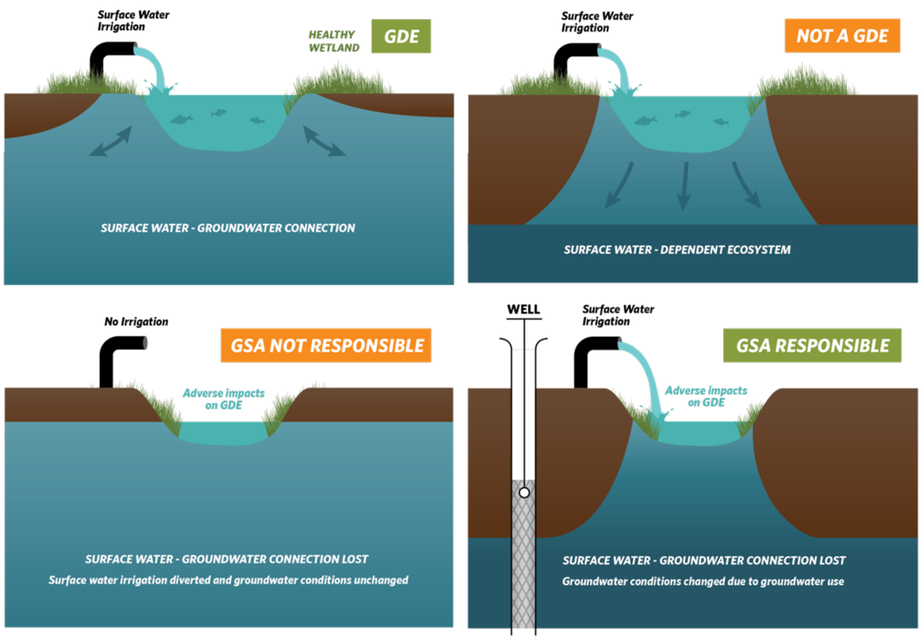

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

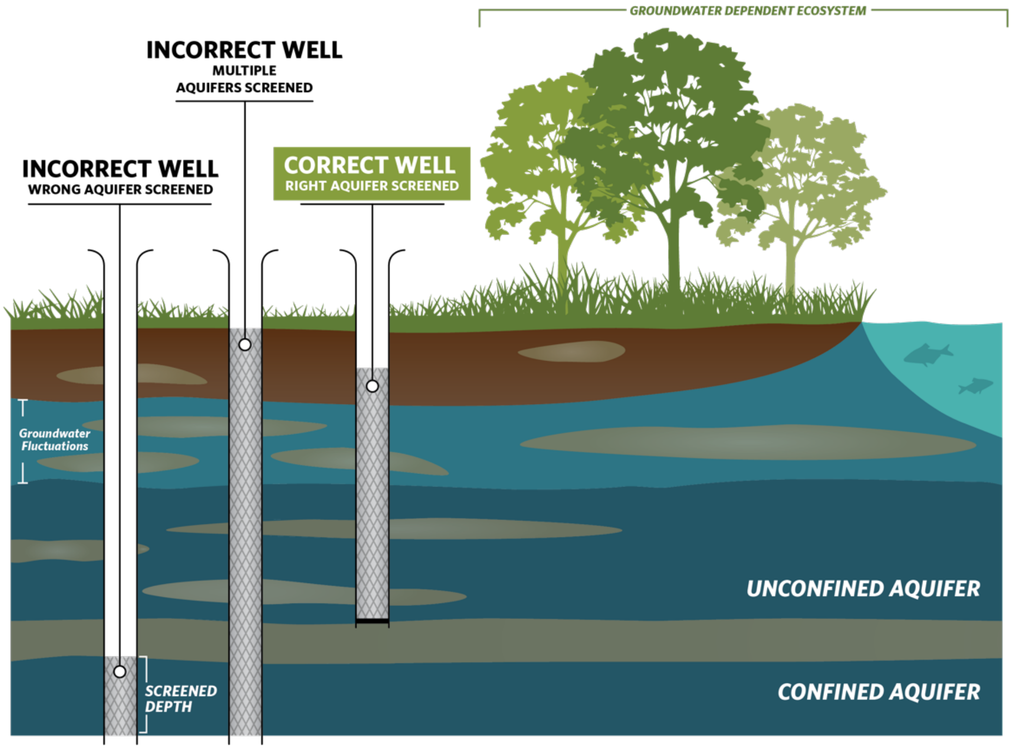

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

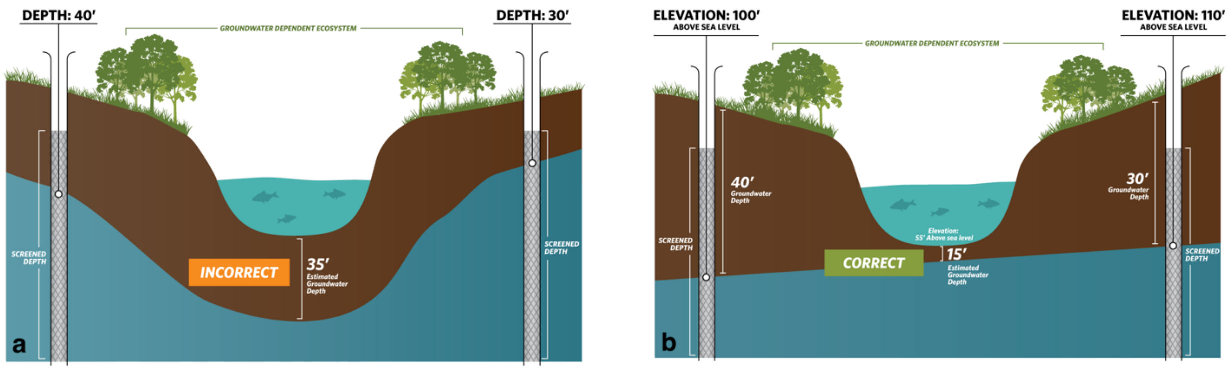

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

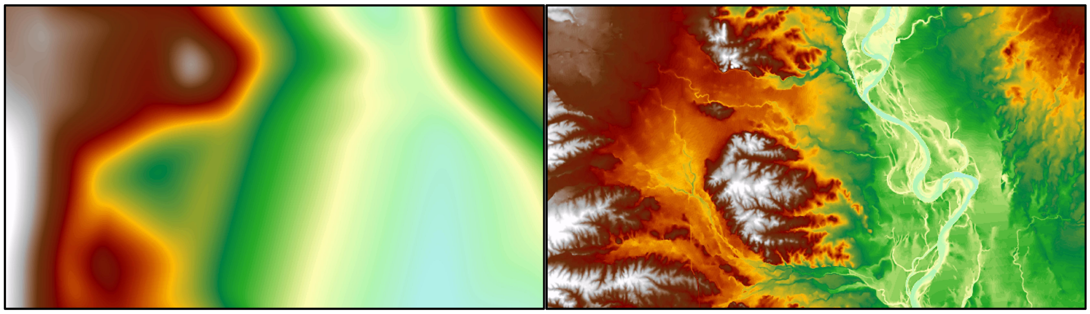

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

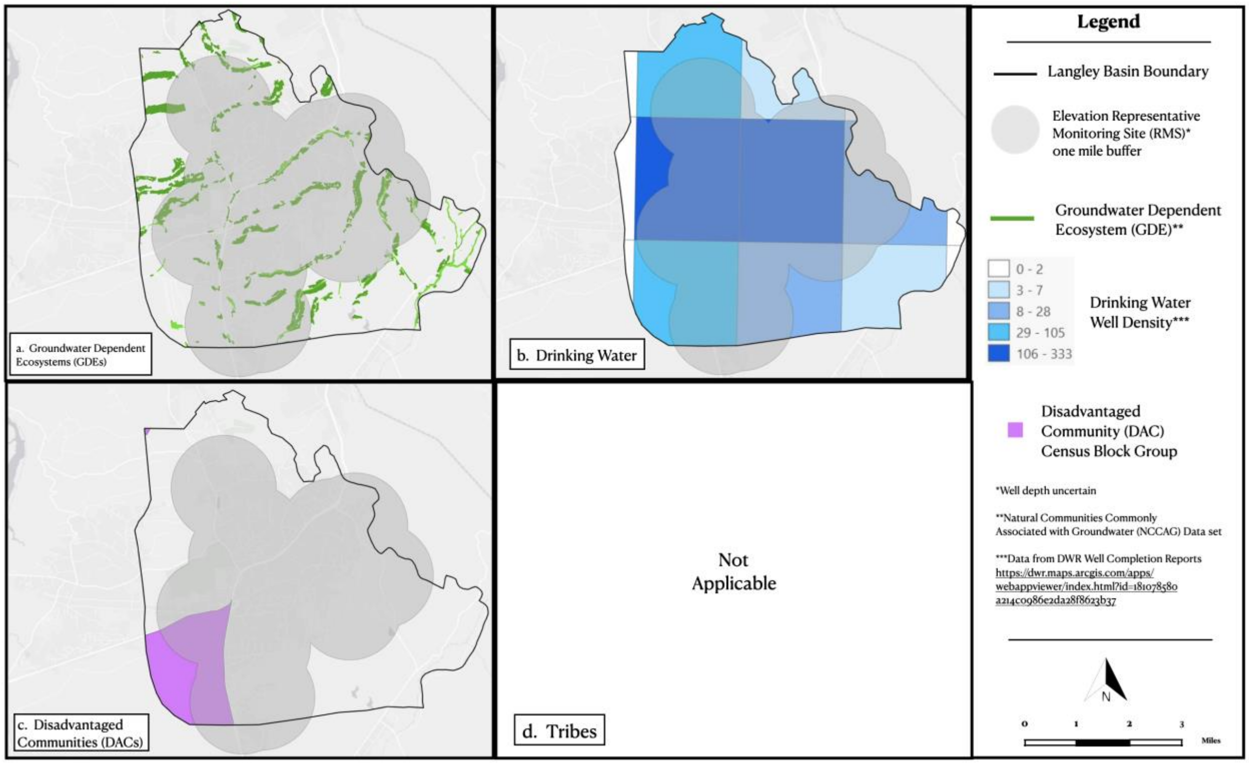

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

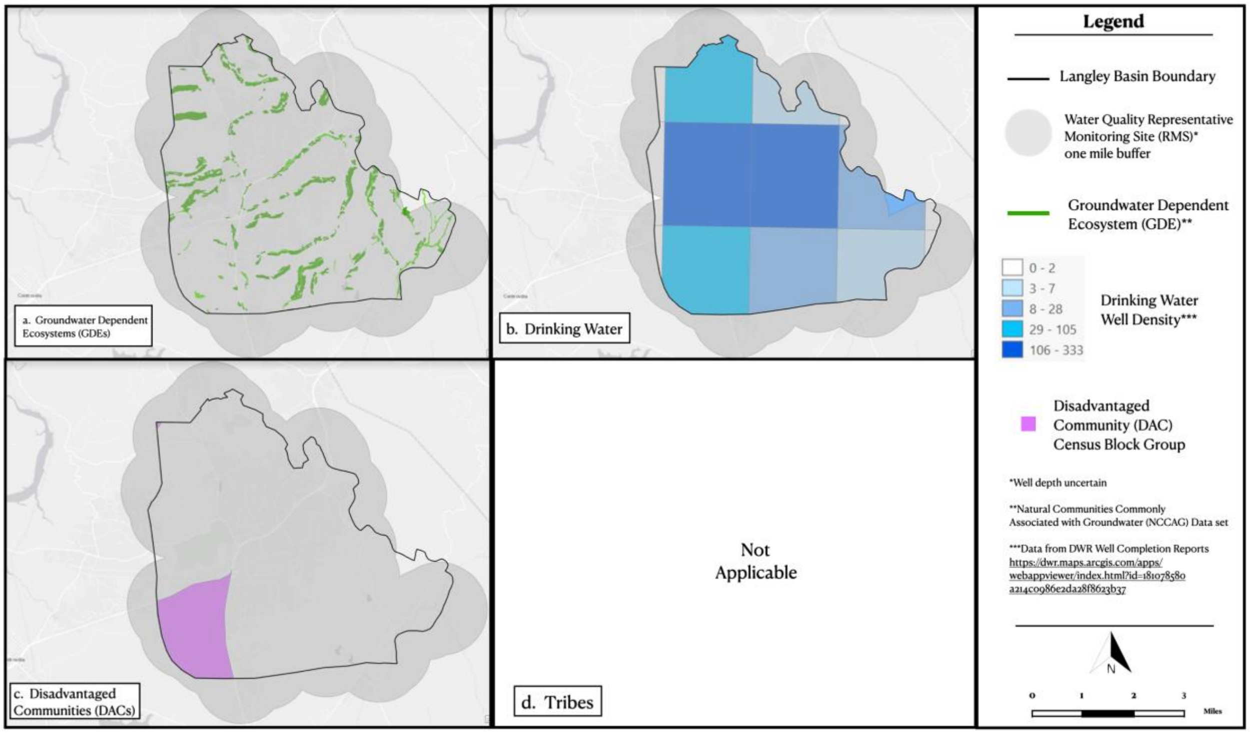

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

November 19, 2021

Tehama County Flood Control and Water Conservation District GSA
9380 San Benito Ave
Gerber, CA 96035

Submitted via email: nbethurem@tcpw.ca.gov

Re: Public Comment Letter for Los Molinos Subbasin Draft GSP

Dear Nichole Bethurem,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Los Molinos Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, tribes, drinking water users, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Los Molinos Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Kristan Culbert
Associate Director, California Central Valley River Conservation
American Rivers

Attachment A

Specific Comments on the Los Molinos Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. We note the following deficiencies with the identification of these key beneficial users. While the plan includes five different tools that were utilized to identify and map DACs within the subbasin including the use of DWR DAC mapping tool, it fails to identify each DAC by name and provide the population of DACs dependent on groundwater as their source of drinking water.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Identify each DAC by name and provide the population of each identified DAC. • Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP describes the use of a groundwater model (Tehama Integrated Hydrologic Model) to analyze the interaction between groundwater and surface water within the subbasin. While Appendix 2-J gives a detailed description of the model, the GSP could be improved by including a summary in the main GSP text. This information should include groundwater level monitoring well data and stream gauge

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

data that were incorporated into the model, the screening depths of wells used in the groundwater model, and description of the temporal (seasonal and interannual) variability of the data used to calibrate the model.

The GSP does not provide any concluding statements in the GSP text about which reaches are considered to be interconnected. Figure 2-63 (Surface Water and Shallow Groundwater Monitoring Stations) presents stream reaches in the subbasin labeled as perennial and intermittent/ephemeral. However, this figure does not label reaches as interconnected, disconnected, or reaches with data gaps.

RECOMMENDATIONS

- Provide a map showing all the stream reaches in the subbasin, with reaches clearly labeled as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.

- In the main text of the GSP, summarize the groundwater elevation data and stream flow data used in the modeling analysis. Discuss temporal (seasonal and interannual) variability of the data used to calibrate the model.

- To confirm and illustrate the results of the groundwater modeling, overlay the subbasin's stream reaches with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis.

- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). Potential GDEs were identified in areas overlying groundwater within 30 feet of land surface based on Spring 2015 groundwater conditions, but this was the only dataset used to characterize groundwater conditions in the subbasin's GDEs. We recommend using groundwater data from multiple seasons and water year types over the pre-SGMA period (i.e., 2005-2015) to determine the range of depth to groundwater. Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying GDEs and is necessary to capture the variability in groundwater conditions inherent in California's Mediterranean climate. The GDE Appendix (Appendix 2-H) refers to Figure 1 through Figure 4 that illustrate the steps of the GDE analysis. These figures appear to be missing from the appendix, however.

The GSP does not provide an inventory of flora and fauna in the subbasin, nor is any discussion of threatened or endangered species provided.

RECOMMENDATIONS

- Include the missing Figures 1-4 in the GDE Appendix 2-H.
- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.
- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape.
- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as Valley Oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether Valley Oak polygons from the NC Dataset are connected to groundwater. It is important to emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and proximity to other water sources.
- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.
- Provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin and note any threatened or endangered species (see Attachment C in this letter for a list of freshwater species located in the Los Molinos Subbasin).

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of native vegetation into the water budget is **sufficient**. We commend the GSA for including the groundwater demands of this ecosystem in the historical, current and projected water budgets. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the subbasin.

[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

RECOMMENDATION
● State whether or not there are managed wetlands in the subbasin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Communications and Engagement Plan (Appendix 2-A).[4]

We note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement in very general terms for listed stakeholders. Public outreach and engagement activities include public meetings, public hearings, stakeholder briefings with Groundwater Commission members, public educational workshops, notices to cities and counties within the Plan area, quarterly newsletters, and opportunities to provide comments. While the GSP provides a guidance document on DAC engagement, its description consists primarily of informing DACs by outreach to DAC-related organizations. The GSP does not state whether DACs and environmental stakeholders are represented on a GSA Advisory Committee or Board.

- The plan does not include documentation on how stakeholder input from the above mentioned outreach and engagement was considered and incorporated into the GSP development process.

- We note that Appendix G of the Communications and Engagement Plan, called "Potential GSA Outreach Tasks," is still under development and will include more details of outreach to stakeholders during GSP implementation. Ensure that as this section is finalized, it includes a detailed plan for continual opportunities for engagement through the *implementation* phase of the GSP that is specifically directed to DACs, domestic well owners, and environmental stakeholders.

RECOMMENDATIONS
● In the Communications and Engagement Plan, describe active and targeted outreach to engage all stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. While some of these resources have already been stated in the GSP, we recommend that the GSA should improve utilization of these resources and documentation of the engagement process.

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- Provide documentation on how stakeholder input was incorporated into the GSP development process.
- Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the subbasin.[5]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP states (p. 3-19): *"The MTs were set to the following: Upper Aquifer: Spring groundwater elevation where less than 10 - 20% (on average) of domestic wells could potentially be impacted."* No further details are provided on the minimum threshold impacts to domestic wells, including the methodology used to conduct the assessment. The GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs or drinking water users when defining undesirable results, nor does it describe how the groundwater levels minimum thresholds are consistent with Human Right to Water policy.[9]

The undesirable result for chronic lowering of groundwater levels is established as (p. 3-32): *"25% of groundwater elevations measured at the same RMS wells exceed the associated MTs for two (2) consecutive measurements. If the water year is dry or critically dry, then levels below the MTs are not undesirable if groundwater management allows for recovery in average or wetter years."* By only using minimum threshold exceedances during non-drought years to define undesirable results for groundwater levels, significant and unreasonable impacts to beneficial users experienced during dry years or periods of drought will not result in an undesirable result. This is problematic since this subbasin is experiencing dry wells with this current drought and the GSP is failing to manage the subbasin in such a way that strives to minimize significant adverse impacts to beneficial users, which are often felt greatest in below-average, dry, and drought years. Furthermore, the requirement that 25% of monitoring wells exceed the minimum threshold before triggering an undesirable result means that areas with high concentrations of domestic

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[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

wells may experience impacts significantly greater than the established minimum threshold because the 25% threshold isn't triggered.

For degraded water quality, minimum thresholds are set for total dissolved solids (TDS) to 750 milligrams per liter (mg/L), lower than the upper secondary maximum contaminant level (SMCL) of 1,000 mg/L. This is the only constituent for which SMC are established. Section 2.1.3.7 (Migration of Contaminated Groundwater) and Section 2.2.2.3 (Groundwater Quality) discuss other constituents of concern (COCs), both naturally occurring and those associated with industrial activities, that have exceeded regulatory standards. SMC should be established for all COCs in the subbasin that may be impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and domestic well owners when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels. Include information on the impacts during prolonged periods of below average water years.

- Consider minimum threshold exceedances during drought years when defining the groundwater level undesirable result across the subbasin.

Degraded Water Quality

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality.[10] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[11]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that are impacted or exacerbated by groundwater use and/or management.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC.

[10] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[11] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

Sustainable management criteria for depletion of interconnected surface water are established by proxy using groundwater levels. The GSP states (p. 3-28): "*Minimum thresholds are interim and will be the same water levels used in for the chronic lowering of groundwater elevations described in Section 3.3.1.1. Extensive data gaps are discussed in Section 3.7.8.7. The GSA will continue to evaluate new monitoring information and determine these thresholds later.*" While the GSP clearly recognizes the data gap for depletion of interconnected surface water SMC, we would like to see further discussion of how the interim SMC will affect beneficial users, and more specifically GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. The GSP makes no attempt to evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin.[12] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[13]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[14] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,15]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."

[12] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[13] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[14] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]
[15] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at:
https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[16] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[17] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios provided by DWR into projected water budgets or selecting more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP integrates climate change into key inputs (e.g., changes in precipitation, evapotranspiration, and surface water flow) of the projected water budget, and calculates a sustainable yield based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of extreme climate scenarios, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, GDEs, and ISWs in the subbasin. These beneficial users may remain unprotected by the GSP without

[16] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]
[17] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[18]

Figure 3-1 (Representative Monitoring Sites) shows insufficient representation of DACs and drinking water users for water quality monitoring. Figure 3-2 (Groundwater Level Representative Monitoring Sites – Upper Aquifer) and Figure 3-3 (Groundwater Level Representative Monitoring Sites – Lower Aquifer) show insufficient representation of DACs, GDEs, and drinking water users for groundwater elevation monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater.

The GSP provides some discussion of data gaps for GDEs in Section 3.7.8.7 (Assessment and Improvement of Monitoring Network - Interconnected Surface Waters), but does not provide specific plans, such as locations or a timeline, to fill the data gaps. In addition, Figure 3-7 (Identification of Data Gaps (GDE)) is missing.

RECOMMENDATIONS

- Provide the missing Figure 3-7 (Identification of Data Gaps (GDE)).
- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify monitored areas.
- Increase the number of RMSs in the shallow aquifer across the subbasin as needed to map ISWs and adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMSs.
- Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.
- Further describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin. Additional studies of GDEs and groundwater - surface water interactions are briefly discussed in the Projects and Management Actions chapter, but very few details are provided.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **sufficient** due to the plan's clear identification of the benefits and impacts of projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs and DACs.

We commend the GSA for including projects and management actions to improve water supply in the subbasin and GDE habitats (e.g., Deer Creek Instream Flow Enhancements and Conjunctive Use Management Projects, Lower Deer Creek Improvements and Habitat Restoration Projects). We also

[18] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

commend the GSA for describing the environmental benefits of the Multi-Benefit Recharge Project (Section 4.3.3) in the subbasin, as developed with support and guidelines from The Nature Conservancy.

The GSP describes the Tehama County Domestic Well Tracking and Outreach Program (Section 4.5.2.6) and the Well Deepening or Replacement Program (Section 4.5.2.7). However, these programs are described as potential projects to be implemented on an as-needed basis, instead of projects that will be implemented within the GSP planning horizon. Given the number of drinking water wells going dry within the subbasin as reported by DWR's Household Water Shortage reporting tool,[19] we strongly recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation.

RECOMMENDATIONS

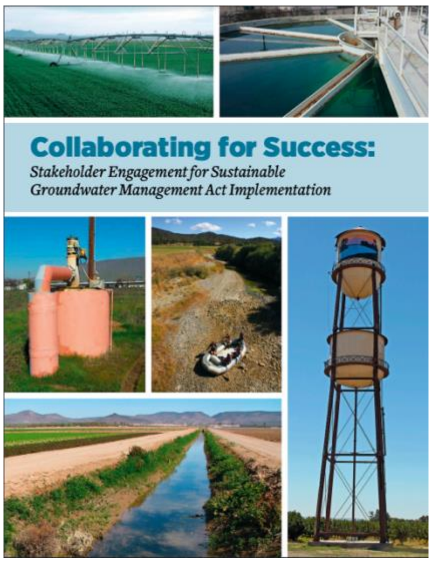
- For DACs and domestic well owners, provide specific plans for implementation of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[19]DWR Household Water Shortage reporting tool. Available at: https://mydrywell.water.ca.gov/report/publicpage

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

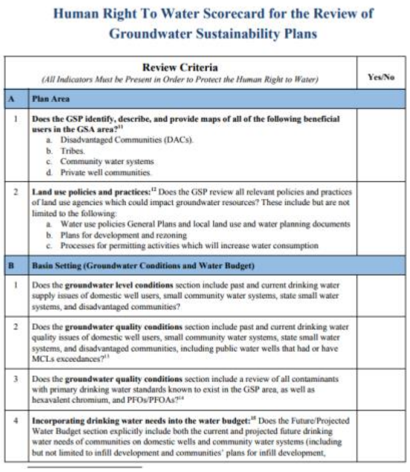
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

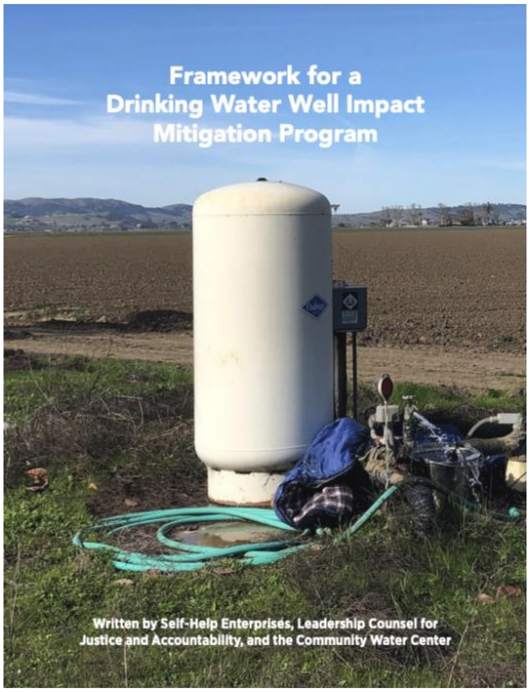


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

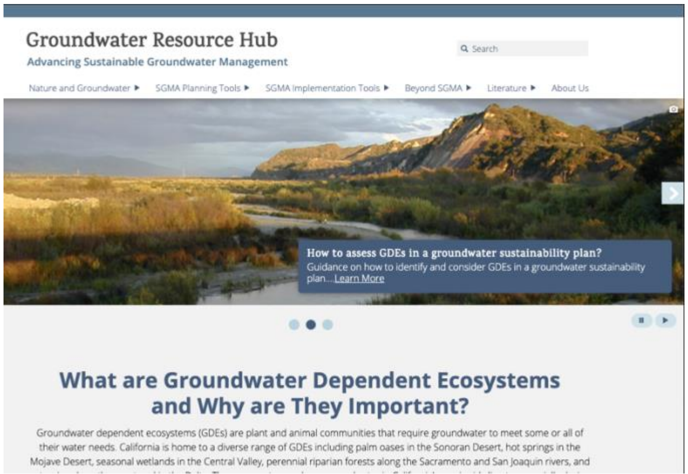
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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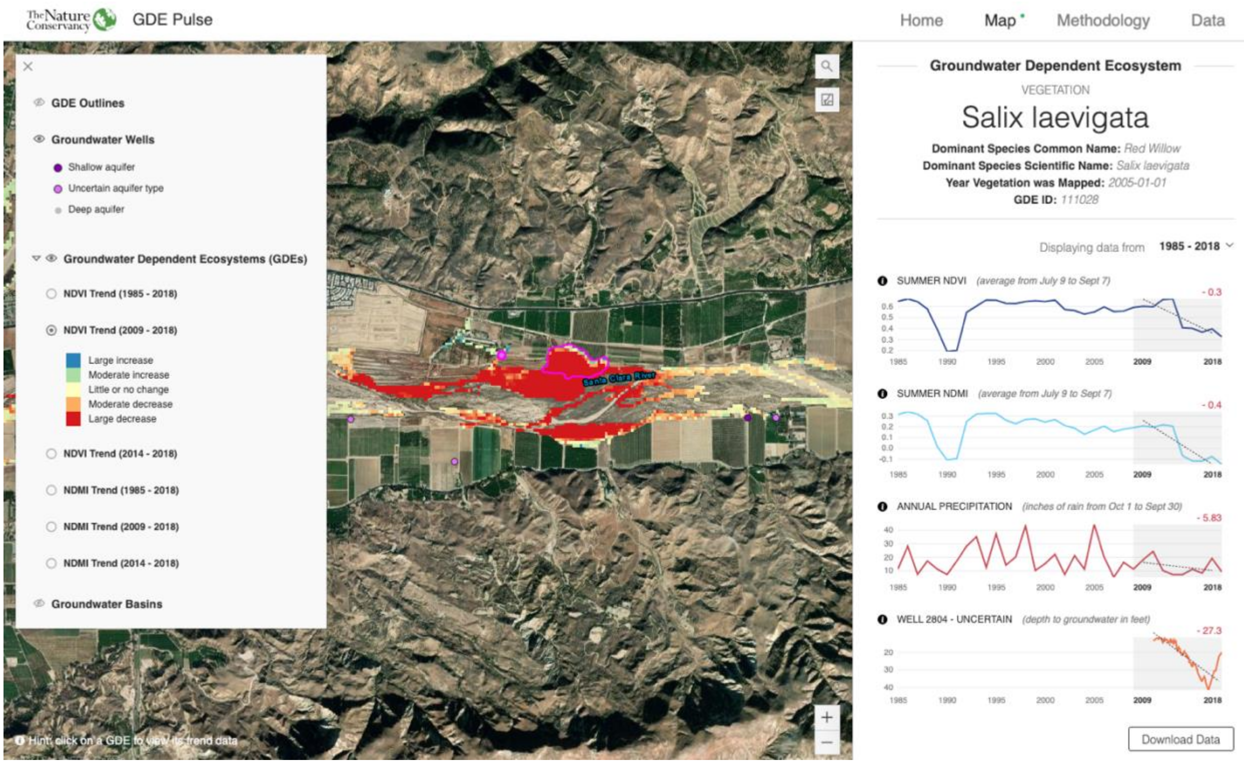
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

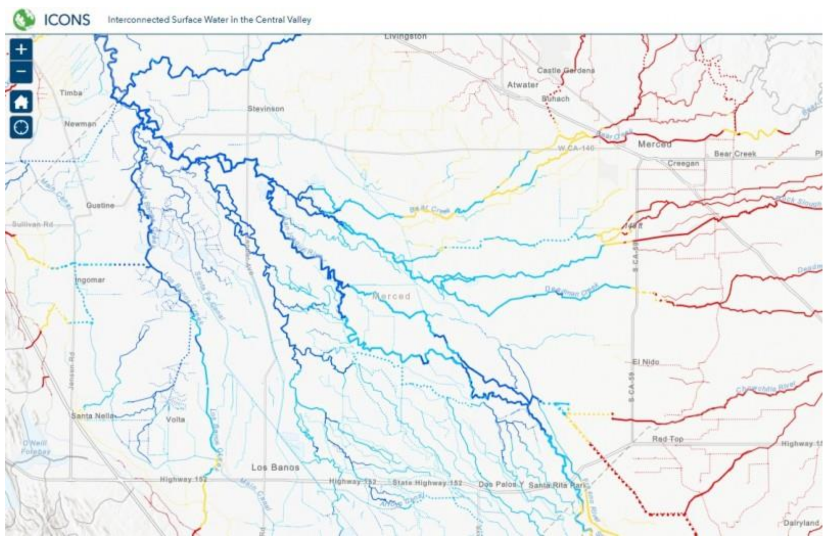
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Los Molinos Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Los Molinos Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Candidate - Threatened	Endangered	
Riparia riparia	Bank Swallow		Threatened	
Actitis macularius	Spotted Sandpiper			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas platyrhynchos	Mallard			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Butorides virescens	Green Heron			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Geothlypis trichas trichas	Common Yellowthroat			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Pandion haliaetus	Osprey		Watch list	

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
CRUSTACEANS				
Branchinecta conservatio	Conservancy Fairy Shrimp	Endangered	Special	IUCN - Endangered
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Hyalella azteca	An Amphipod			
Hyalella spp.	Hyalella spp.			
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endangered	Endangered	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				

Ablabesmyia annulata				Not on any status lists
Ablabesmyia spp.	Ablabesmyia spp.			
Acentrella insignificans	A Mayfly			
Acentrella spp.	Acentrella spp.			
Acentrella turbida	A Mayfly			
Ambrysus amargosus	Ash Meadows Naucorid			
Ambrysus mormon				Not on any status lists
Ambrysus spp.	Ambrysus spp.			
Amiocentrus aspilus	A Caddisfly			
Anopheles franciscanus				Not on any status lists
Anopheles spp.	Anopheles spp.			
Antocha monticola				Not on any status lists
Antocha spp.	Antocha spp.			
Apedilum spp.	Apedilum spp.			
Aquarius amplus arizonensis				Not on any status lists
Aquarius spp.	Aquarius spp.			
Argia agrioides	California Dancer			
Argia spp.	Argia spp.			
Asioplax edmundsi	A Mayfly			
Asioplax spp.	Asioplax spp.			
Atherix pachypus				Not on any status lists
Atractelmis wawona	Wawona Riffle Beetle		Special	
Baetis adonis	A Mayfly			
Baetis flavistriga	A Mayfly			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Blepharicera jordani				Not on any status lists
Blephari
cera spp.	Blephariцera spp.			
Brachycentrus occidentalis				Not on any status lists
Brillia flavifrons				Not on any status lists
Brillia spp.	Brillia spp.			
Caenis amica	A Mayfly			
Caenis latipennis	A Mayfly			
Calineuria californica	Western Stone			
Callibaetis californicus	A Mayfly			
Callibaetis spp.	Callibaetis spp.			
Cardiocladius platypus				Not on any status lists
Cardiocladius spp.	Cardiocladius spp.			
Caudatella columbiella				Not on any status lists

Caudatella spp.	Caudatella spp.			
Cheumatopsyche analis				Not on any status lists
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chimarra adella				Not on any status lists
Chimarra spp.	Chimarra spp.			
Chimarra utahensis	A Caddisfly			
Chironomidae fam.	Chironomidae fam.			
Chironomus anonymus				Not on any status lists
Chironomus spp.	Chironomus spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus annulator				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus curryi				Not on any status lists
Cryptochironomus spp.	Cryptochironomus spp.			
Dicrotendipes adnilus				Not on any status lists
Dicrotendipes spp.	Dicrotendipes spp.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Dubiraphia brunnescens	Brownish Dubiraphian Riffle Beetle		Special	
Dubiraphia spp.	Dubiraphia spp.			
Enallagma anna	River Bluet			
Enallagma spp.	Enallagma spp.			
Epeorus albertae	A Mayfly			
Epeorus spp.	Epeorus spp.			
Ephemerella aurivillii	A Mayfly			
Eukiefferiella claripennis				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Glossosoma alascense	A Caddisfly			
Glossosoma oregonense	A Caddisfly			
Glossosoma spp.	Glossosoma spp.			
Glyptotendipes spp.	Glyptotendipes spp.			
Helichus suturalis				Not on any status lists
Helicopsyche borealis	A Caddisfly			
Helicopsyche spp.	Helicopsyche spp.			
Hesperoperla pacifica	Golden Stone			
Hetaerina americana	American Rubyspot			
Hetaerina spp.	Hetaerina spp.			
Hydrophilidae fam.	Hydrophilidae fam.			

Hydropsyche alternans				Not on any status lists
Hydropsyche californica	A Caddisfly			
Hydropsyche occidentalis	A Caddisfly			
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila ajax	A Caddisfly			
Hydroptila arctia	A Caddisfly			
Hydroptila lenora				Not on any status lists
Hydroptila spp.	Hydroptila spp.			
Hygrotus acaroides				Not on any status lists
Hygrotus spp.	Hygrotus spp.			
Isonychia intermedia				Not on any status lists
Isonychia spp.	Isonychia spp.			
Labrundinia maculata				Not on any status lists
Labrundinia spp.	Labrundinia spp.			
Laccobius acutipenis				Not on any status lists
Laccobius spp.	Laccobius spp.			
Laccophilus biguttatus				Not on any status lists
Laccophilus spp.	Laccophilus spp.			
Lauterborniella spp.	Lauterborniella spp.			
Lepidostoma acarolum				Not on any status lists
Lepidostoma spp.	Lepidostoma spp.			
Leptoceridae fam.	Leptoceridae fam.			
Macromia magnifica	Western River Cruiser			
Microcylloepus formicoideus	Furnace Creek Riffle Beetle		Special	
Microcylloepus spp.	Microcylloepus spp.			
Microtendipes caducus				Not on any status lists
Microtendipes spp.	Microtendipes spp.			
Microvelia beameri				Not on any status lists
Microvelia spp.	Microvelia spp.			
Mideopsis spp.	Mideopsis spp.			
Mystacides alafimbriatus	A Caddisfly			
Mystacides spp.	Mystacides spp.			
Nanocladius anderseni				Not on any status lists
Nanocladius spp.	Nanocladius spp.			
Natarsia miripes				Not on any status lists
Natarsia spp.	Natarsia spp.			

Nectopsyche dorsalis	A Caddisfly			
Nectopsyche spp.	Nectopsyche spp.			
Neotrichia blinni				Not on any status lists
Neotrichia spp.	Neotrichia spp.			
Ochrotrichia alexanderi	A Caddisfly			
Ochrotrichia spp.	Ochrotrichia spp.			
Ochrotrichia stylata	A Caddisfly			
Octogomphus specularis	Grappletail			
Oecetis arizonica				Not on any status lists
Oecetis avara	A Caddisfly			
Oecetis disjuncta	A Caddisfly			
Oecetis spp.	Oecetis spp.			
Ophiogomphus arizonicus				Not on any status lists
Ophiogomphus occidentis	Sinuous Snaketail			
Ophiogomphus spp.	Ophiogomphus spp.			
Optioservus canus	Pinnacles Optioservus Riffle Beetle		Special	
Optioservus quadrimaculatus				Not on any status lists
Optioservus seriatus				Not on any status lists
Optioservus spp.	Optioservus spp.			
Orthocladius appersoni				Not on any status lists
Orthocladius spp.	Orthocladius spp.			
Oxyethira spp.	Oxyethira spp.			
Paratanytarsus grimmii				Not on any status lists
Paratanytarsus spp.	Paratanytarsus spp.			
Pentaneura inconspicua				Not on any status lists
Pentaneura spp.	Pentaneura spp.			
Petrophila confusalis				Not on any status lists
Petrophila spp.	Petrophila spp.			
Phaenopsectra dyari				Not on any status lists
Phaenopsectra spp.	Phaenopsectra spp.			
Polycentropus arizonensis				Not on any status lists
Polycentropus spp.	Polycentropus spp.			
Polypedilum albicorne				Not on any status lists
Polypedilum spp.	Polypedilum spp.			
Procladius barbatulus				Not on any status lists

Procladius spp.	Procladius spp.			
Progomphus borealis	Gray Sanddragon			
Prosimulium caudatum				Not on any status lists
Prosimulium esselbaughi				Not on any status lists
Prosimulium spp.	Prosimulium spp.			
Protanyderus margarita				Not on any status lists
Protanyderus spp.	Protanyderus spp.			
Protoptila balmorhea				Not on any status lists
Protoptila coloma	A Caddisfly			
Protoptila spp.	Protoptila spp.			
Psephenus arizonensis				Not on any status lists
Psephenus falli				Not on any status lists
Psephenus spp.	Psephenus spp.			
Pseudochironomus richardsoni				Not on any status lists
Pseudochironomus spp.	Pseudochironomus spp.			
Psychomyia flavida	A Caddisfly			
Pteronarcys californica	Giant Salmonfly			
Pteronarcys spp.	Pteronarcys spp.			
Rhagovelia becki				Not on any status lists
Rhagovelia spp.	Rhagovelia spp.			
Rheotanytarsus hamatus				Not on any status lists
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhithrogena decora	A Mayfly			
Rhithrogena spp.	Rhithrogena spp.			
Rhyacophila acuminata	A Caddisfly			Not on any status lists
Rhyacophila spp.	Rhyacophila spp.			
Serratella levis	A Mayfly			
Serratella micheneri	A Mayfly			
Serratella spp.	Serratella spp.			
Sialis spp.	Sialis spp.			
Sigara alternata				Not on any status lists
Sigara spp.	Sigara spp.			
Simulium anduzei				Not on any status lists
Simulium spp.	Simulium spp.			
Skwala americana	American Springfly			
Skwala spp.	Skwala spp.			
Sperchon spp.	Sperchon spp.			

Stenocolus scutellaris				Not on any status lists
Tanytarsus angulatus				Not on any status lists
Tanytarsus spp.	Tanytarsus spp.			
Tinodes belisus	A Caddisfly			
Tinodes spp.	Tinodes spp.			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus californicus				Not on any status lists
Tropisternus spp.	Tropisternus spp.			
Tvetenia spp.	Tvetenia spp.			
Tvetenia vitracies				Not on any status lists
Uvarus amandus				Not on any status lists
Uvarus spp.	Uvarus spp.			
Wormaldia anilla	A Caddisfly			
Wormaldia spp.	Wormaldia spp.			
Zaitzevia parvula				Not on any status lists
Zaitzevia spp.	Zaitzevia spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Fluminicola ahjumawi	Ahjumawi pebblesnail			V
Fluminicola spp.	Fluminicola spp.			
Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus spp.	Gyraulus spp.			
Helisoma spp.	Helisoma spp.			
Juga acutifilosa	Topaz Juga		Special	T
Juga spp.	Juga spp.			
Margaritifera falcata	Western Pearlshell		Special	
Menetus spp.	Menetus spp.			
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Planorbidae fam.	Planorbidae fam.			
PLANTS				
Orcuttia pilosa	Hairy Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Orcuttia tenuis	Slender Orcutt Grass	Threatened	Endangered	CRPR - 1B.1

Tuctoria greenei	Green's Awnless Orcutt Grass	Endangered	Rare	CRPR - 1B.1
Agrostis oregonensis	Oregon Bentgrass			
Allium validum	Tall Swamp Onion			
Alnus rhombifolia	White Alder			
Alopecurus aequalis aequalis	Short-awn Foxtail			
Alopecurus carolinianus	Tufted Foxtail			
Alopecurus geniculatus geniculatus	Meadow Foxtail			
Alopecurus pratensis	NA			
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Ammannia robusta	Grand Redstem			
Aquilegia eximia	Van Houtte's Columbine			
Arundo donax	NA			
Asarum lemmonii	Lemmon's Wild Ginger			
Azolla filiculoides	NA			
Baccharis salicina				Not on any status lists
Bacopa rotundifolia	NA			
Bergia texana	Texas Bergia			
Berula erecta	Wild Parsnip			
Bistorta bistortoides				Not on any status lists
Boehmeria cylindrica	NA			Not on any status lists
Bolboschoenus fluviatilis				Not on any status lists
Bolboschoenus glaucus	NA			Not on any status lists
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Brodiaea nana				Not on any status lists
Callitriche fassettii	NA			Not on any status lists
Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche heterophylla heterophylla	Northern Water-starwort			
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Callitriche trochlearis	Waste-water Water-starwort			
Carex amplifolia	Bigleaf Sedge			
Carex aquatilis aquatilis	Water Sedge			

Carex aurea	Golden-fruit Sedge			
Carex cusickii	Cusick's Sedge			
Carex densa	Dense Sedge			
Carex echinata echinata	Little Prickly Sedge			
Carex feta	Green-sheath Sedge			
Carex hirtissima	Fuzzy Sedge			
Carex integra	Smooth-beak Sedge			
Carex jonesii	Jones' Sedge			
Carex lasiocarpa	Slender Sedge		Special	CRPR - 2B.3
Carex lemmonii	Lemmon's Sedge	Endangered		
Carex limosa	Mud Sedge		Special	CRPR - 2B.2
Carex nebrascensis	Nebraska Sedge			
Carex nervina	Sierra Sedge			
Carex nigricans	Black Alpine Sedge			
Carex nudata	Torrent Sedge			
Carex praeceptorum	Teacher's Sedge			
Carex scopulorum bracteosa	Holm's Rocky Mountain Sedge			
Carex simulata	Copycat Sedge			
Carex spectabilis	Northwestern Showy Sedge			
Carex utriculata	Beaked Sedge			
Carex vesicaria vesicaria	Inflated Sedge			
Carex vulpinoidea	NA			
Castilleja miniata miniata	Greater Red Indian-paintbrush			
Castilleja minor minor	Alkali Indian-paintbrush			
Cephalanthus occidentalis	Common Buttonbush			
Chamaecyparis lawsoniana				Not on any status lists
Cicendia quadrangularis	Oregon Microcala			
Cirsium douglasii breweri				Not on any status lists
Cirsium scariosum scariosum	Drummond's Thistle			Not on any status lists
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Crypsis vaginiflora	NA			
Cyperus acuminatus	Short-point Flatsedge			
Cyperus bipartitus	Shining Flatsedge			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus flavescens	NA			
Cyperus fuscus	NA			
Cyperus involucratus	NA			
Cyperus squarrosus	Awned Cyperus			

Damasonium californicum				Not on any status lists
Darlingtonia californica	California Pitcherplant		Special	CRPR - 4.2
Darmera peltata	Umbrella Plant			
Datisca glomerata	Durango Root			
Downingia bacigalupii	Bacigalup's Downingia			
Downingia bella	Hoover's Downingia			
Downingia bicornuta	NA			
Downingia cuspidata	Toothed Calicoflower			
Downingia insignis	Parti-color Downingia			
Downingia montana	Sierra Downingia			
Downingia ornatissima	NA			
Downingia pulchella	Flat-face Downingia			
Downingia pusilla	Dwarf Downingia		Special	CRPR - 2B.2
Drosera rotundifolia	NA			
Echinochloa oryzoides	NA			
Echinodorus berteroi	Upright Burhead			
Elatine brachysperma	Shortseed Waterwort			
Elatine californica	California Waterwort			
Elatine heterandra	Mosquito Waterwort			
Elatine rubella	Southwestern Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis acicularis gracilescens	Least Spikerush			
Eleocharis atropurpurea	Purple Spikerush			
Eleocharis bella	Delicate Spikerush			
Eleocharis bolanderi	Bolander's Spikerush			
Eleocharis coloradoensis				Not on any status lists
Eleocharis decumbens	Decumbent Spikerush			
Eleocharis engelmannii engelmannii	Engelmann's Spikerush			Not on any status lists
Eleocharis flavescens flavescens	Pale Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Eleocharis obtusa	Blunt Spikerush			
Eleocharis parishii	Parish's Spikerush			
Eleocharis quadrangulata	NA			
Eleocharis quinqueflora	Few-flower Spikerush			
Eleocharis rostellata	Beaked Spikerush			
Eleocharis suksdorfiana	NA			

Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Epilobium oregonense	Oregon Willow-herb			
Epipactis gigantea	Giant Helleborine			
Eragrostis hypnoides	Teal Lovegrass			
Eriophorum gracile gracile	Slender Cotton-grass		Special	CRPR - 4.3
Eryngium alismifolium	Inland Coyote-thistle			
Eryngium aristulatum aristulatum	California Eryngo			
Eryngium articulatum	Jointed Coyote-thistle			
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euphorbia hooveri	NA			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Fimbristylis autumnalis	NA			
Floerkea proserpinacoides	False Mermaidweed			
Galium trifidum	Small Bedstraw			
Gentianella amarella acuta	Autumn Dwarf Gentian			
Gentianopsis simplex	One-flower Gentian			
Glyceria elata	Tall Mannagrass			
Gratiola ebracteata	Bractless Hedge-hyssop			
Gratiola heterosepala	Boggs Lake Hedge-hyssop		Endangered	CRPR - 1B.2
Hastingsia alba	White Rushlily			
Helenium bigelovii	Bigelow's Sneezeweed			
Helenium puberulum	Rosilla			
Heteranthera limosa	NA			
Hosackia oblongifolia	NA			1.B.3
Hydrocotyle ranunculoides	Floating Marsh-pennywort			
Hydrocotyle umbellata	Many-flower Marsh-pennywort			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Isoetes bolanderi	NA			
Isoetes howellii	NA			
Isoetes nuttallii	NA			
Isoetes orcuttii	NA			
Juncus acuminatus	Sharp-fruit Rush			
Juncus articulatus articulatus				Not on any status lists
Juncus dubius	Mariposa Rush			
Juncus effusus pacificus				

Juncus hemiendytus hemiendytus	Dwarf Rush			
Juncus leiospermus	NA		Special	
Juncus mertensianus	Mertens' Rush			
Juncus uncialis	Inch-high Rush			
Juncus usitatus	NA			Not on any status lists
Juncus xiphioides	Iris-leaf Rush			
Kyhosia bolanderi				Not on any status lists
Lasthenia ferrisiae	Ferris' Goldfields		Special	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lemna aequinoctialis	Lesser Duckweed			
Lemna gibba	Inflated Duckweed			
Lemna minor	Lesser Duckweed			
Lemna minuta	Least Duckweed			
Lemna trisulca	Star Duckweed			
Lemna turionifera	Turion Duckweed			
Leucothoe davisiae	Western Doghobble			
Lilium kelleyanum	Kelley's Lily			
Lilium pardalinum pardalinum	Leopard Lily			
Lilium pardalinum shastense	Leopard Lily			
Lilium parvum	Small Tiger Lily			
Limnanthes alba alba	White Meadowfoam			
Limnanthes alba versicolor	White Meadowfoam			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limnanthes douglasii nivea	Douglas' Meadowfoam			
Limnanthes douglasii rosea	Douglas' Meadowfoam			
Limnanthes floccosa californica	Shippee Meadowfoam	Endangered	Endangered	CRPR - 1B.1
Limnanthes floccosa floccosa	Woolly Meadowfoam		Special	CRPR - 4.2
Limosella acaulis	Southern Mudwort			
Limosella aquatica	Northern Mudwort			
Lindernia dubia	Yellowseed False Pimpernel			
Lipocarpha micrantha	Dwarf Bulrush			
Ludwigia palustris	Marsh Seedbox			
Ludwigia peploides montevidensis	NA			Not on any status lists
Ludwigia peploides peploides	NA			Not on any status lists
Lupinus polyphyllus polyphyllus	Bigleaf Lupine			

Lycopus americanus	American Bugleweed			
Lythrum californicum	California Loosestrife			
Lythrum portula	NA			
Marsilea vestita vestita	NA			Not on any status lists
Menyanthes trifoliata	Bog Buckbean			
Micranthes aprica				Not on any status lists
Micranthes odontoloma				Not on any status lists
Micranthes oregana	NA			Not on any status lists
Myosotis laxa	Small Forget-me-not			
Myosurus apetalus	Bristly Mousetail			
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Myriophyllum aquaticum	NA			
Najas gracillima	NA			
Najas guadalupensis guadalupensis	Southern Naiad			
Navarretia cotulifolia	Cotula Navarretia			
Navarretia heterandra	Tehama Navarretia			
Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala bakeri	Baker's Navarretia		Special	CRPR - 1B.1
Navarretia leucocephala leucocephala	White-flower Navarretia			
Navarretia leucocephala minima	Least Navarretia			
Oenanthe sarmentosa	Water-parsley			
Oreostemma alpigenum andersonii	Anderson's Tundra Aster			
Orthilia secunda	One-side Wintergreen			
Oxypolis occidentalis	Western Cowbane			
Panicum acuminatum acuminatum				Not on any status lists
Panicum dichotomiflorum	NA			
Paspalum distichum	Joint Paspalum			
Pedicularis attollens	NA			
Pedicularis groenlandica	NA			
Perideridia bolanderi bolanderi	Bolander's Yampah			
Perideridia bolanderi involucrata	Bolander's Yampah			
Perideridia kelloggii	Kellogg's Yampah			
Perideridia lemmonii	Lemmon's Yampah			
Perideridia oregana	Oregon Yampah			

Perideridia parishii latifolia	Parish's Yampah			
Persicaria hydropiper	NA			Not on any status lists
Persicaria hydropiperoides				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phacelia distans	NA			
Pilularia americana	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys austiniae	Austin's Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plagiobothrys tener	NA			
Plantago elongata elongata	Slender Plantain			
Platanthera sparsiflora sparsiflora	Canyon Bog Orchid			
Platanus racemosa	California Sycamore			
Pogogyne douglasii	NA			
Pogogyne zizyphoroides				Not on any status lists
Populus trichocarpa	NA			Not on any status lists
Porterella carnosula	Western Porterella			
Potamogeton diversifolius	Water-thread Pondweed			
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton gramineus	Grassy Pondweed			
Potamogeton illinoensis	Illinois Pondweed			
Potamogeton natans	Floating Pondweed			
Potamogeton nodosus	Longleaf Pondweed			
Potamogeton pusillus pusillus	Slender Pondweed			
Primula tetrandra	NA			Not on any status lists
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			

Psilocarphus oregonus	Oregon Woolly-heads			
Ranunculus alismifolius alismellus	Water-plantain Buttercup			
Ranunculus alismifolius alismifolius	Water-plantain Buttercup			
Ranunculus alismifolius hartwegii				Not on any status lists
Ranunculus aquatilis aquatilis	White Water Buttercup			
Ranunculus bonariensis	NA			
Ranunculus flammula flammula	Lesser Spearwort			
Ranunculus hystriculus				Not on any status lists
Ranunculus pusillus pusillus	Pursh's Buttercup			
Ranunculus repens	NA			
Ranunculus sardous	NA			
Ranunculus sceleratus	NA			
Rhododendron columbianum				Not on any status lists
Rhododendron occidentale occidentale	Western Azalea			
Rhynchospora californica	California Beakrush		Special	CRPR - 1B.1
Rhynchospora capitellata	Brownish Beakrush		Special	CRPR - 2B.2
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rorippa palustris palustris	Bog Yellowcress			
Rotala ramosior	Toothcup			
Sagina saginoides	Arctic Pearlwort			
Sagittaria cuneata	Wapatum Arrowhead			
Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Sagittaria longiloba	Longbarb Arrowhead			
Sagittaria montevidensis calycina				Not on any status lists
Sagittaria sanfordii	Sanford's Arrowhead		Special	CRPR - 1B.2
Salix boothii	Booth's Willow			
Salix eastwoodiae	Eastwood's Willow			
Salix exigua exigua	Narrowleaf Willow			
Salix geyeriana	Geyer's Willow			
Salix gooddingii	Goodding's Willow			
Salix hookeriana	Hooker's Willow			
Salix jepsonii	Jepson's Willow			
Salix laevigata	Polished Willow			

Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix lemmonii	Lemmon's Willow			
Salix melanopsis	Dusky Willow			
Salix sitchensis	Sitka Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus californicus	California Bulrush			
Schoenoplectus mucronatus	NA			
Schoenoplectus tabernaemontani	Softstem Bulrush			
Scirpus congdonii	Congdon's Bulrush			
Scirpus diffusus	Umbrella Bulrush			
Scirpus microcarpus	Small-fruit Bulrush			
Senecio triangularis	Arrow-leaf Groundsel			
Sequoia sempervirens				
Sidalcea calycosa calycosa	Annual Checker-mallow			
Sidalcea hirsuta	Hairy Checker-mallow			
Sidalcea oregana hydrophila	Water-loving Checker-mallow		Special	CRPR - 1B.2
Sidalcea oregana oregana	Oregon Checker-mallow			
Sisyrinchium elmeri	Elmer's Blue-eyed-grass			
Solidago elongata				Not on any status lists
Sphenosciadium capitellatum	Swamp Whiteheads			
Spiranthes romanzoffiana	Hooded Ladies'-tresses			
Spirodela polyrhiza	NA			
Stachys ajugoides	Bugle Hedge-nettle			
Stachys pycnantha	Short-spike Hedge-nettle			
Stachys stricta	Sonoma Hedge-nettle			
Stuckenia pectinata				Not on any status lists
Taxus brevifolia				
Toxicoscordion venenosum venenosum				Not on any status lists
Triglochin maritima	Common Bog Arrow-grass			
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Utricularia gibba	Humped Bladderwort			
Veronica americana	American Speedwell			

Veronica anagallis-aquatica	NA			
Viola macloskeyi	NA			
Wolffia brasiliensis	Pointed Watermeal		Special	CRPR - 2B.3
Zannichellia palustris	Horned Pondweed			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

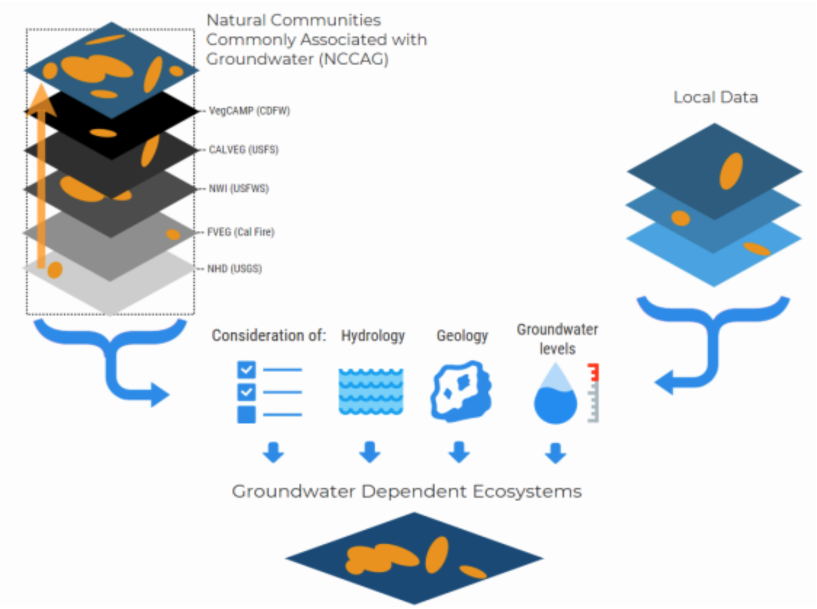


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

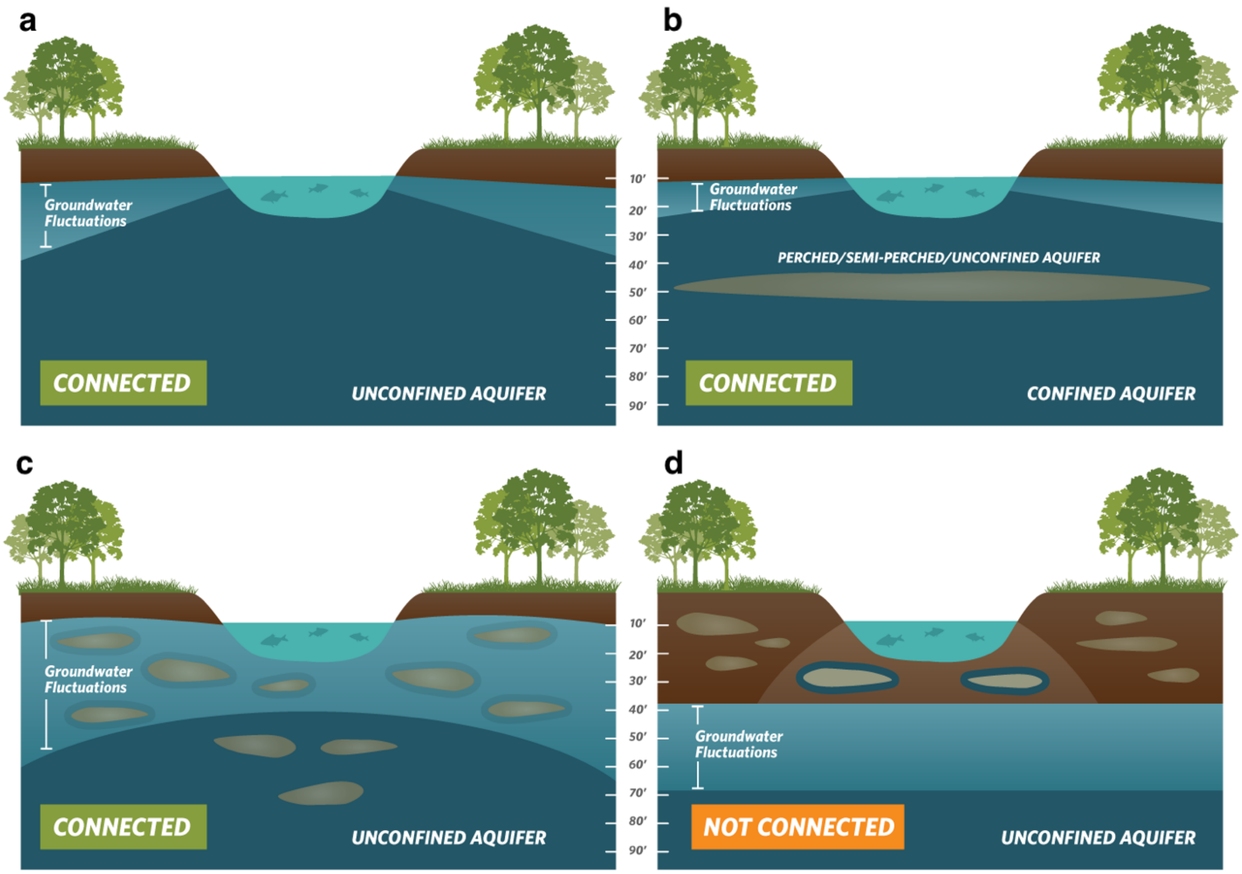


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

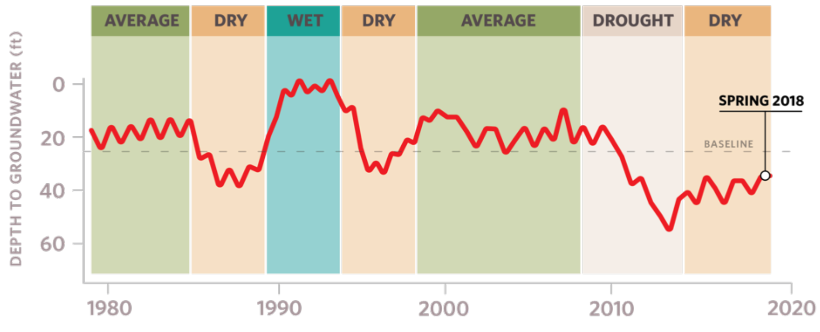


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

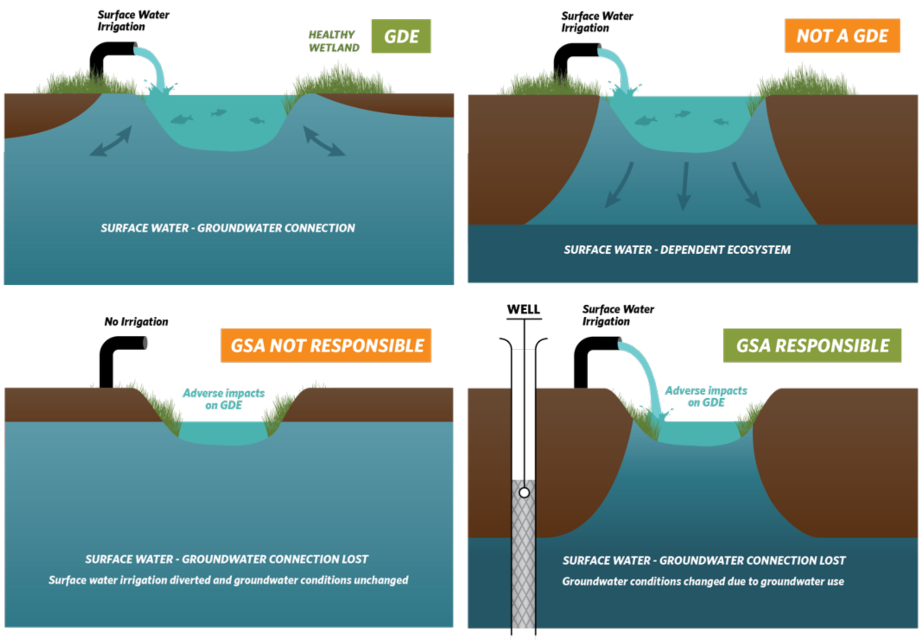

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

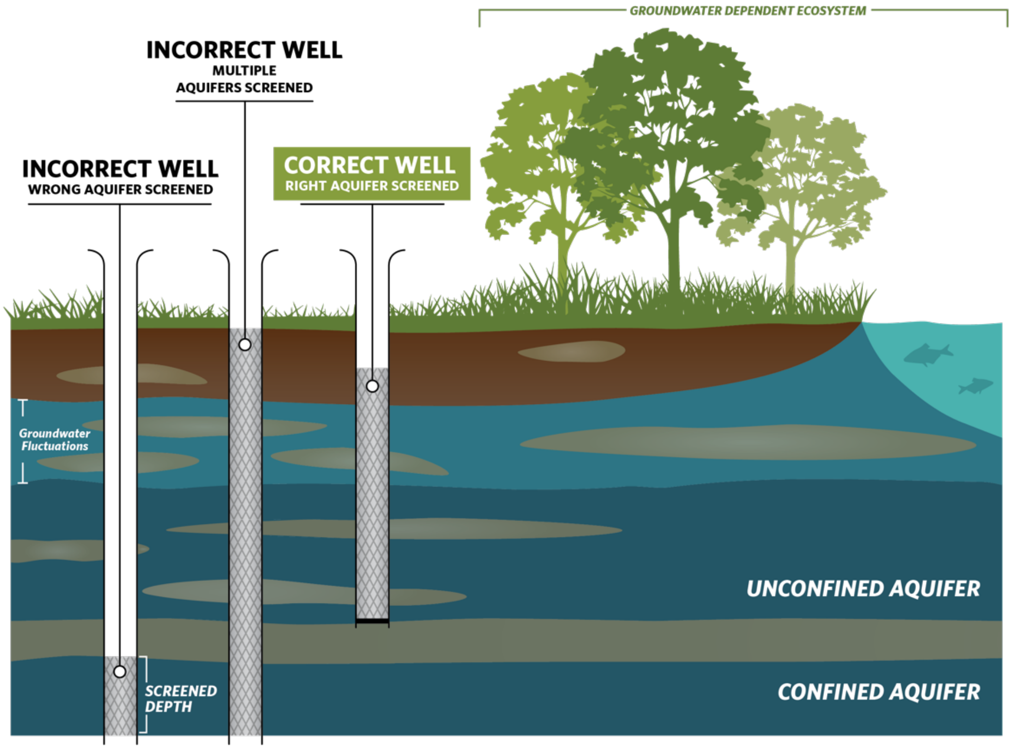

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

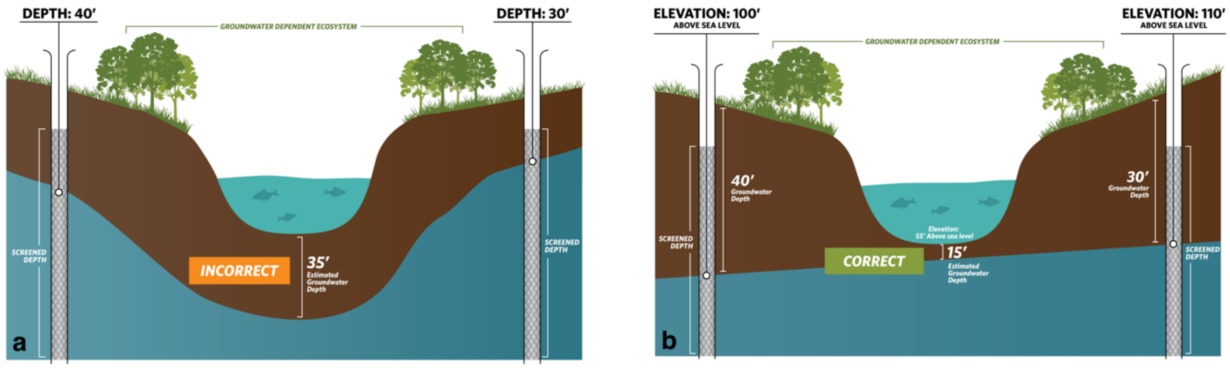

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

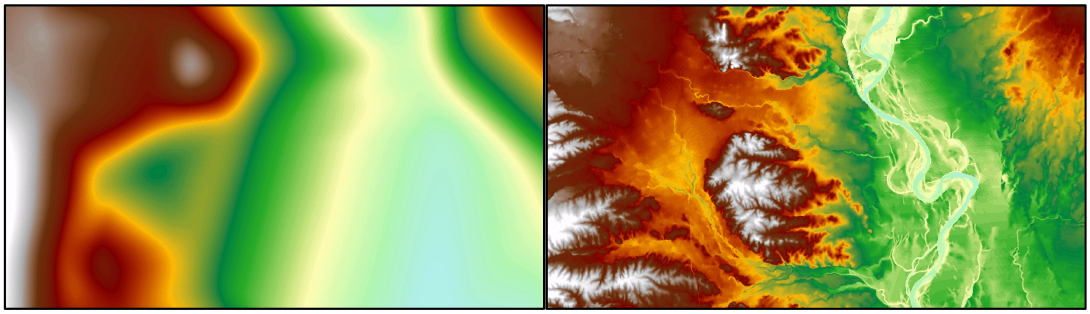

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

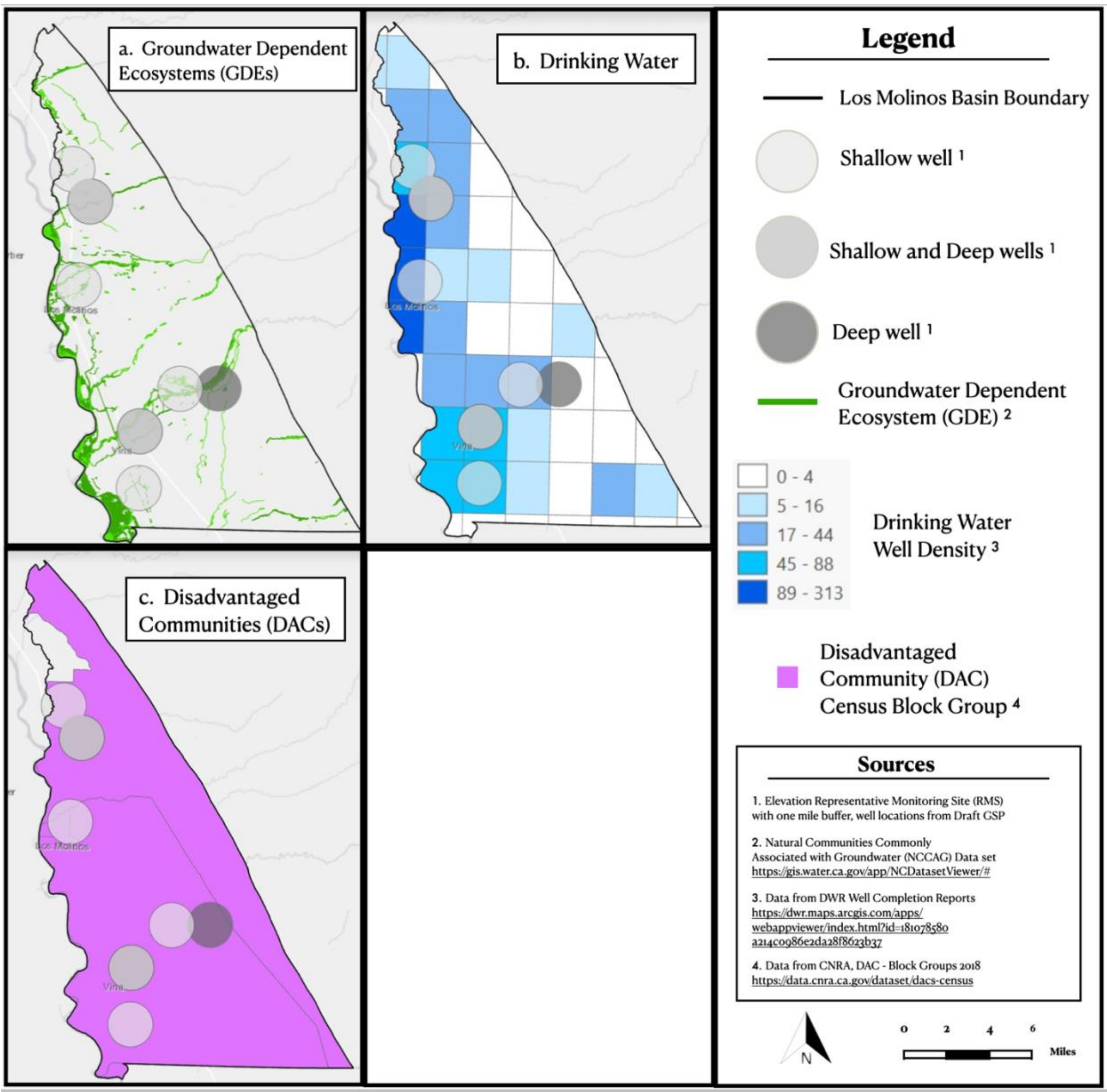

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

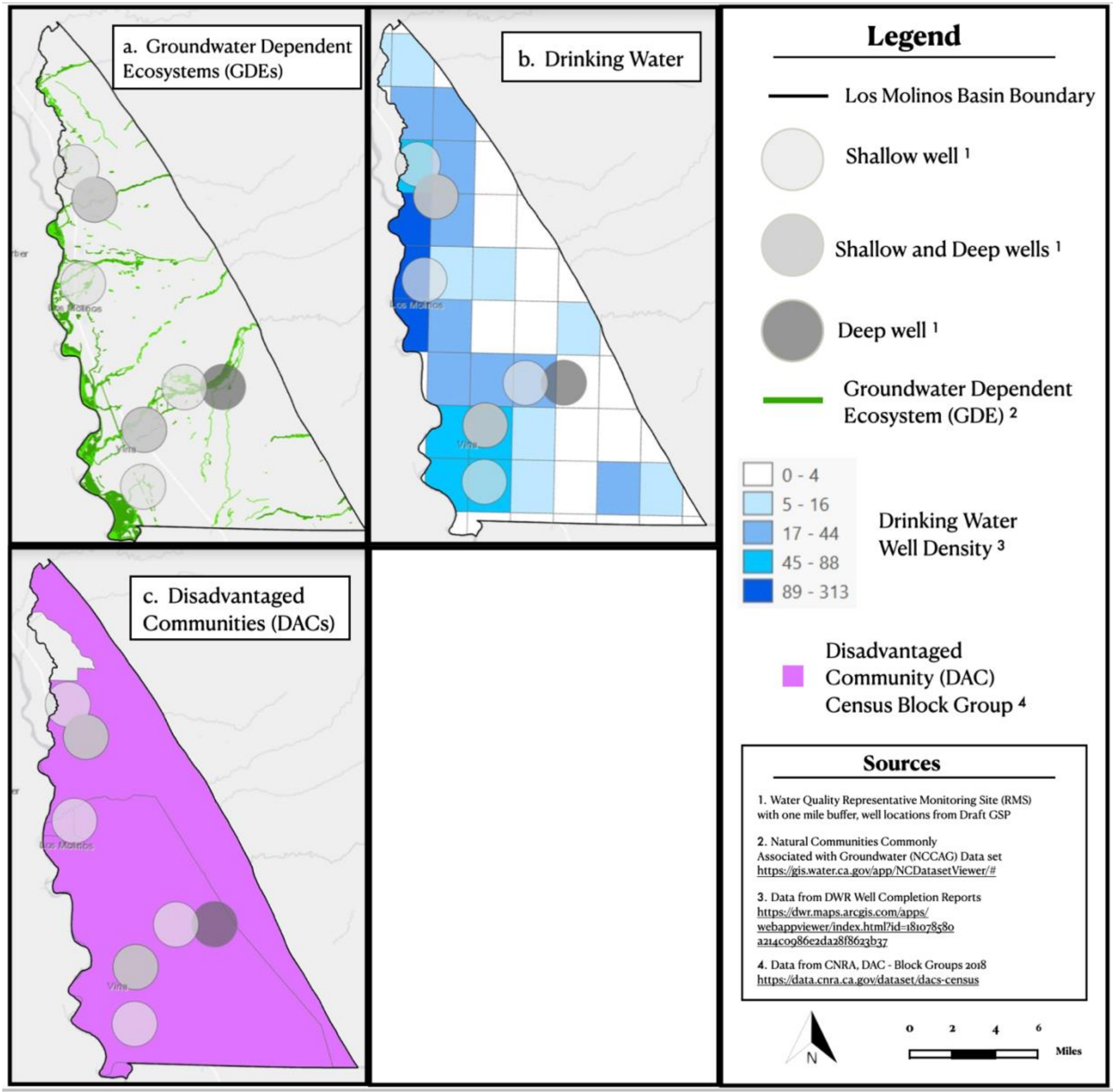

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

December 15, 2021

Stanislaus and Tuolumne Rivers Groundwater Basin Association GSA
1231 11th Street
Modesto, CA 95354

Submitted via email: strgba@mid.org

Re: Public Comment Letter for Modesto Subbasin Draft GSP

Dear John Davids,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Modesto Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Modesto Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Modesto Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP provides information on DACs, including identification by name and location on a map (Figure 4-1), as well as the population dependent on groundwater as their source of drinking water in the subbasin. However, the GSP fails to clearly state the population of each DAC.

The GSP provides a density map of domestic wells in the subbasin (Figure 2-14). However, the plan fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin. This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the subbasin.

These missing elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide the population of each identified DAC. • Include a map showing domestic well locations and average well depth across the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **insufficient**. The GSP states that the ISW analysis is awaiting modeling results. As this analysis is finalized for the final GSP, note our recommendations listed below.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

RECOMMENDATIONS
• Provide a map of streams in the subbasin. Clearly label reaches as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP. • Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015. • To confirm and illustrate the results of the modeling analysis, overlay the subbasin's stream reaches on depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis. • For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset), but states that the analysis of GDEs will be continued after the analysis of ISWs is complete. As this analysis is finalized for the final GSP, note our recommendations listed below.

RECOMMENDATIONS
• Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. • Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as “Potential GDEs” in the GSP until data gaps are reconciled in the monitoring network.
- Provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin and note any threatened or endangered species (see Attachment C in this letter for a list of freshwater species located in the Modesto Subbasin).

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of these ecosystems into the water budget is **insufficient**. The water budget did explicitly include the current, historical, and projected demands of native vegetation, but did not include the current, historical, and projected demands of managed wetlands. Managed wetlands are not mentioned in the GSP, but are present in DWR’s statewide cropping dataset on the SGMA Data Viewer. The omission of explicit water demands for managed wetlands is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

RECOMMENDATION

- Discuss and map the presence of managed wetlands in the subbasin. Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including managed wetlands.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development

Stakeholder engagement during GSP development is **insufficient**. SGMA’s requirement for public notice and engagement of stakeholders is not fully met by the description in the Communication and Engagement Plan (Appendix D).[4]

The plan states that Modesto Subbasin Stakeholder Assessment was conducted as part of the stakeholder assessment, however it was based on a small sample size and the results show that

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[2] “’Water use sector’ refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation.” [23 CCR §351(al)]

[3] “The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.” [23 CCR §354.18]

[4] “A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin.” [23 CCR §354.10(d)(3)]

the assessment did not include beneficial users including DAC members, domestic well owners, or environmental stakeholders.

The GSP documents direct outreach to DACs within the City of Modesto, City of Oakdale, City of Waterford, and Stanislaus County, and notes that the interests of these DACs are represented on the GSA Committee and Technical Advisory Committee by city representatives. However, we note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement in very general terms for listed stakeholders. Public notice and engagement activities include monthly GSA Committee and Technical Advisory Committee meetings, notifications via the GSA website, emails to the Interested Parties Database, public workshops, and GSP Office Hours for informational purposes. Table 4-1 (Nature of Consultation with Beneficial Users) of the Communication and Engagement Plan does not include environmental stakeholder representation on the GSA Committee or Technical Advisory Committee for the subbasin, and the GSP does not document targeted outreach to environmental stakeholders.

- The plan does not include documentation on how stakeholder input from the above-mentioned outreach and engagement was solicited, considered, and incorporated into the GSP development process, or how it will continue into the GSP implementation phase.

RECOMMENDATIONS
• In the Communication and Engagement Plan, describe active and targeted outreach to engage all stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. • Provide documentation on how stakeholder input was incorporated into the GSP development process. • Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the subbasin.[5]

[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP provides discussion of the impact on domestic wells from the recent drought. The GSP states (p. 6-13): *"For this GSP, the widespread impacts to water supply wells during the 2014-2017 drought (which were caused by then-historic groundwater level declines) are considered to be undesirable results. Although impacts appear to be mostly mitigated at current groundwater levels, the GSP strives to avoid similar undesirable results in the future by arresting chronic groundwater level declines in the Subbasin."* Minimum thresholds are set to the historic low groundwater elevation observed or estimated during water years 1991-2020 at each representative monitoring location. The GSP justifies this in part with the following statement (p. 6-18): *"The large number of new and deeper domestic wells drilled since 2015 can reasonably be assumed to accommodate current low water levels, with some tolerance for future droughts."* However, despite the discussion of impacts to domestic wells during the previous drought, no quantitative data is provided on the impact to current domestic wells.

The GSP does not sufficiently describe whether minimum thresholds set by the GSAs will avoid significant and unreasonable loss of drinking water to domestic well users, especially given the absence of a domestic well impact mitigation plan in the GSP. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs or drinking water users when defining undesirable results, nor does it describe how the groundwater level minimum thresholds are consistent with the Human Right to Water policy and will avoid significant and unreasonable impacts on these beneficial users.[9]

The GSP establishes an undesirable result to be when at least 33% of representative monitoring wells exceed the minimum threshold for a principal aquifer in three consecutive fall monitoring events. Using this definition of undesirable results for groundwater levels, significant and unreasonable impacts to beneficial users experienced during dry years or periods of drought will not result in an undesirable result. This is problematic since the GSP is failing to manage the subbasin in such a way that strives to minimize significant adverse impacts to beneficial users, which are often felt greatest in below-average, dry, and drought years. Furthermore, the requirement that one-third of monitoring wells exceed the minimum threshold before triggering an undesirable result means that areas with high concentrations of domestic wells may experience impacts significantly greater than the established minimum threshold because the one-third threshold isn't triggered.

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[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

For degraded water quality, minimum thresholds are set as the primary or secondary California maximum contaminant level (MCL) for water quality constituents of concern (COCs), which include both anthropogenic and naturally-occurring COCs. Measurable objectives are defined as the historical maximum concentration of each constituent of concern at each representative monitoring location. The GSP establishes undesirable results as follows (p. 6-37): *"An undesirable result will occur when a Subbasin potable water supply well in the defined monitoring network reports a new (first-time) exceedance of an MT or an increase in concentration above the MT for a Modesto Subbasin constituent of concern that results in increased operational costs and is caused by GSA management activities as listed above."*

The GSP only includes a very general discussion of impacts on drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds for degraded water quality. The GSP does not, however, mention or discuss direct and indirect impacts on DACs when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users and DACs when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels. Include information on the impacts during prolonged periods of below average water years.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users and DACs within the subbasin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be fully or partially de-watered at the minimum threshold.

- Consider minimum threshold exceedances during single dry years when defining the groundwater level undesirable result across the subbasin.

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users and DACs when defining undesirable results for degraded water quality.[10] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[11]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users and DACs.

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[10] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[11] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC for chronic lowering of groundwater levels. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. The GSP justifies the consideration of impacts to GDEs for only the depletion of interconnected surface water sustainability indicator by stating that GDEs are primarily located near surface water features. However, Figure 3-60 (Vegetation Commonly Associated with Groundwater and Wetlands) shows GDEs in areas of the subbasin that are non-adjacent to surface water.

Sustainable management criteria for depletion of interconnected surface water are established by proxy using groundwater levels. Minimum thresholds are defined as the low groundwater elevation observed in Fall 2015 at each representative monitoring location. Undesirable results are established as follows (p. 6-60): *"An undesirable result will occur on either the Tuolumne or Stanislaus rivers when 33% of representative monitoring wells for that river exceed the MT in three consecutive Fall monitoring events. An undesirable result will occur on the San Joaquin River when 50% of representative monitoring wells for that river exceed the MT in three consecutive Fall monitoring events."* However, if minimum thresholds are set to drought-level low groundwater levels and the subbasin is allowed to operate at or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse. No analysis or discussion is presented to describe how the SMC will affect beneficial users, and more specifically GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the

subbasin.[12] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[13]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[14] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[8,15]

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[16] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[17] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2070. However, the GSP does not indicate whether multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) were considered in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios provided by DWR into projected water budgets, or selecting more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring and their consideration is not required (only suggested) by DWR, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

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[12] “The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results”. [23 CCR §354.26(b)(3)]

[13] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.” [23 CCR §354.28(b)(4)]

[14] “The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results.” [23 CCR §354.28(c)(6)]

[15] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California’s threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[16] “Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow.” [23 CCR §354.18(e)]

[17] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

The GSP integrates climate change into key inputs (e.g., changes in precipitation, evapotranspiration, and surface water flow) of the projected water budget. However, the sustainable yield is based on the projected baseline water budget, instead of the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios and the omission of climate change projections in the sustainable yield calculations, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS
• Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions. • Calculate sustainable yield based on the projected water budget with climate change incorporated. • Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of adequate Representative Monitoring Sites (RMSs) in the monitoring network that represent shallow groundwater elevations around DACs, domestic wells, GDEs, and ISWs in the subbasin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[18]

We note that the plan includes a strategy to improve the monitoring network stated as follows (p. 7-3): "*In addition to the representative wells in the monitoring networks, the GSAs will measure groundwater elevations in over 40 existing wells. These wells will be designated as SGMA monitoring wells, and will not be used to monitor the sustainability indicators, and therefore do not have MTs and MOs. However, groundwater elevation data collected from the SGMA monitoring wells will be used for monitoring overall groundwater conditions and support analyses, such as the preparation of groundwater elevation contour maps. As part of the GSP five-year update, water level data from the SGMA monitoring wells will be compared to data from representative monitoring wells and these wells can be added to the monitoring network to reduce uncertainty or address data gaps, as needed.*"

Figure 7-4 (Water Quality Monitoring Sites) shows sufficient representation of DACs and drinking water users for the water quality monitoring network. Maps of shallow and deep wells within the subbasin (Figures 7-1 to 7-3) show insufficient spatial representation of DACs and drinking water users for the groundwater elevations monitoring network, particularly in areas with the highest density of drinking water wells. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater. Note that we were only able to map groundwater elevation RMSs with information provided in the Draft GSP.

[18] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

The GSP states (p. 7-14): "*The GSAs have adopted a Management Action to make ongoing improvements to the current GSP monitoring network (see Section 8.x). Additional improvements to the monitoring network are envisioned in the first five years of GSP implementation as described in Section 8.x*." Chapter 8 of the GSP (Projects and Management Actions) fails to provide specific projects and management actions that address shallow groundwater wells within the subbasin. Additionally, the GSP does not provide specific plans, such as locations or a timeline, to fill the mentioned data gaps.

RECOMMENDATIONS
• Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify monitored areas. • Increase the number of RMSs in the shallow aquifer across the subbasin as needed to map ISWs and adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMSs. • Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs. • Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin. • Clarify which section of Chapter 8 provides further discussion of improvements to the monitoring network. Ensure the GSP includes specific plans to address data gaps for GDEs and ISWs.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **incomplete**. The GSP identifies benefits and impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as DACs and drinking water users. However, the projects and management actions to improve water supply and GDE habitats (e.g., Voluntary Conservation and/or Land Fallowing) are described as potential projects without a known timeline for implementation.

We note that the plan does not include a domestic well mitigation program to avoid significant and unreasonable loss of drinking water. We strongly recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation.

RECOMMENDATIONS
• For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP

implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[19]

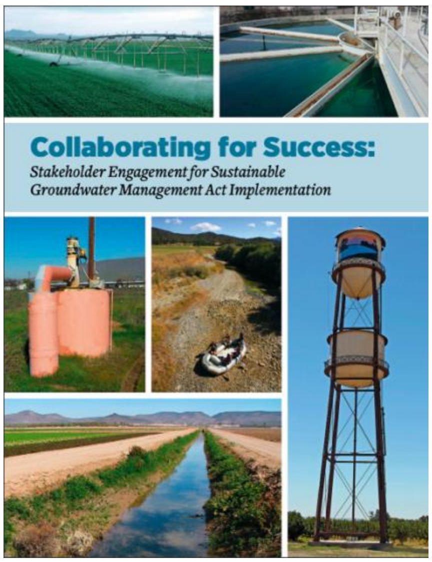
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[19] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

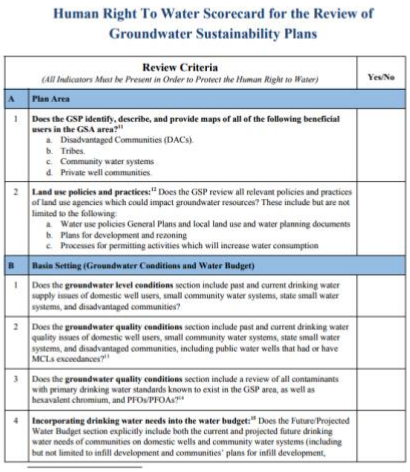
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

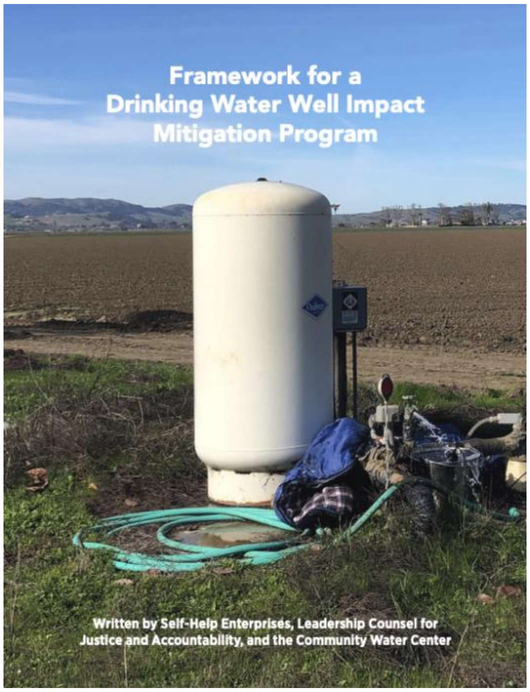


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*		Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

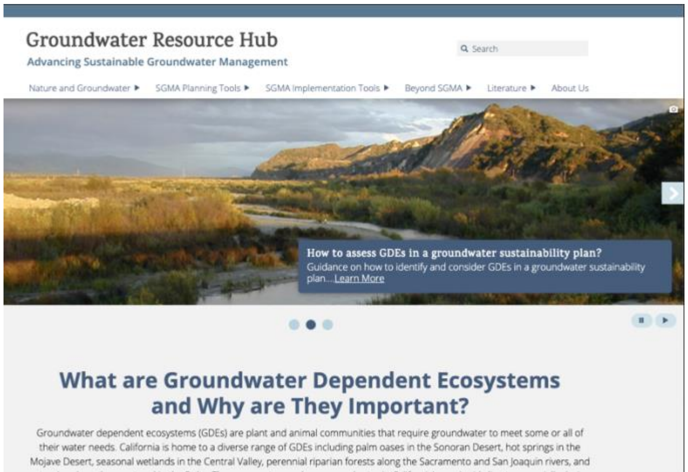
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



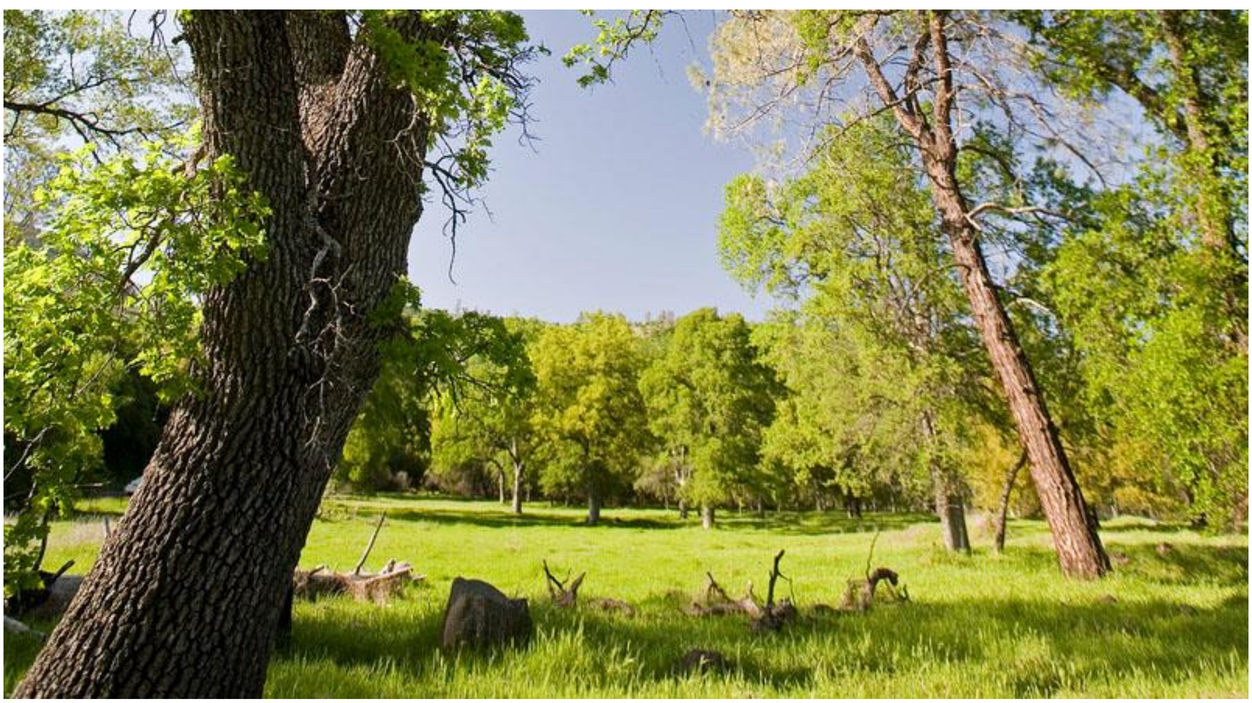
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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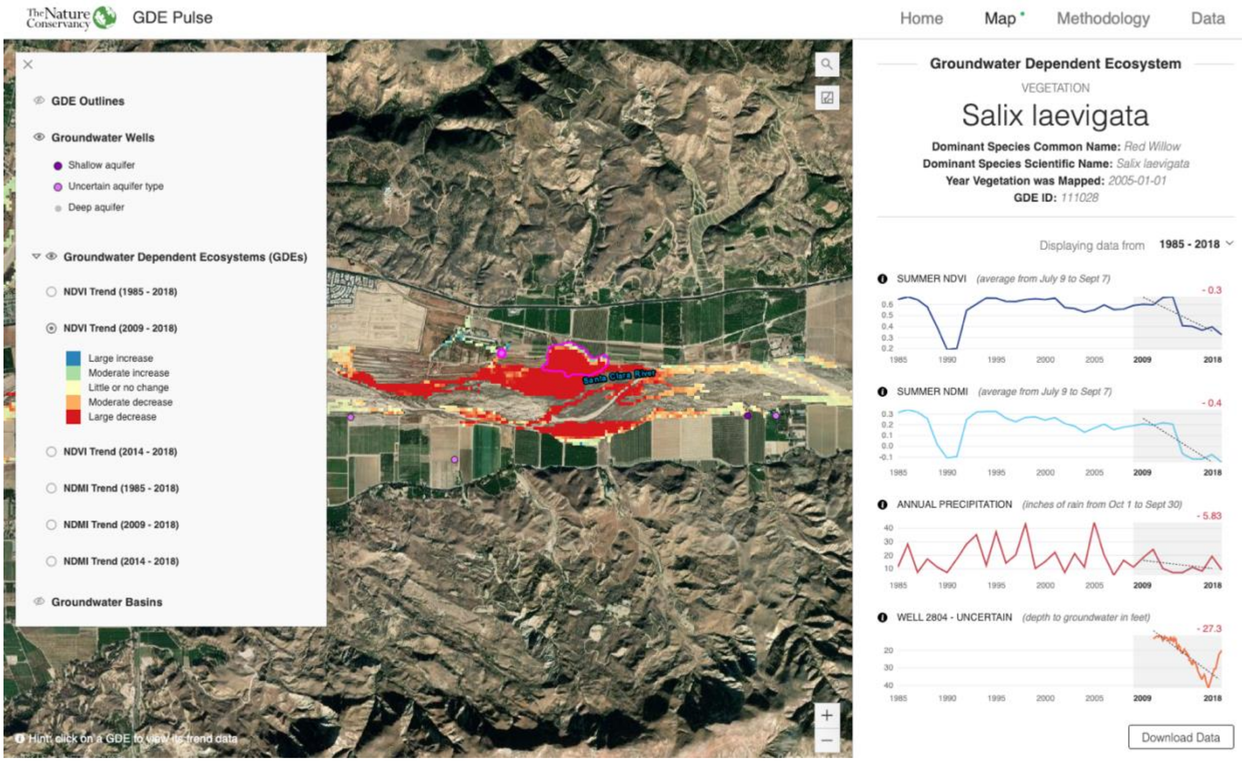
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

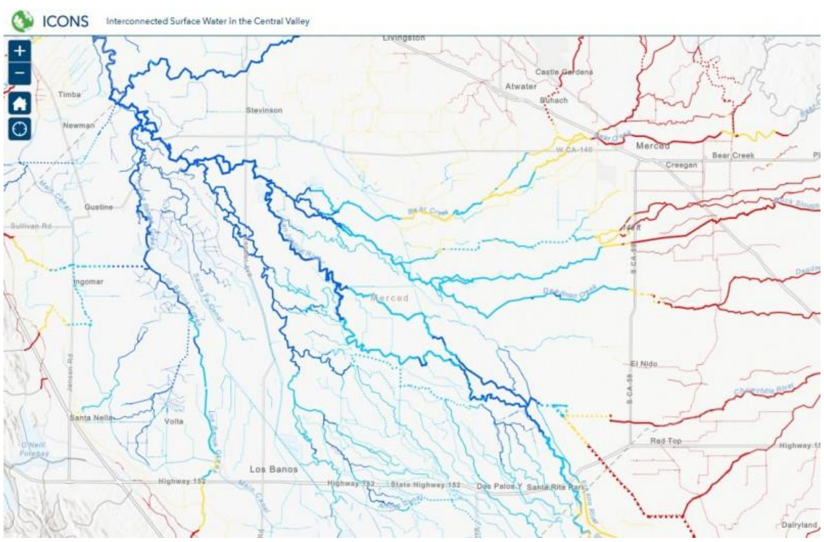
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Modesto Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Modesto Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	**State**	**Other**
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			

Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta conservatio	Conservancy Fairy Shrimp	Endangered	Special	IUCN - Endangered
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
Pacifastacus leniusculus leniusculus	Signal Crayfish			
Stygobromus spp.	Stygobromus spp.			
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Mylopharodon conocephalus	Hardhead		Special Concern	Near-Threatened - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			

Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Ablabesmyia spp.	Ablabesmyia spp.			
Attenella delantala	A Mayfly			
Baetidae fam.	Baetidae fam.			
Baetis tricaudatus	A Mayfly			
Camelobaetidius spp.	Camelobaetidius spp.			
Centroptilum spp.	Centroptilum spp.			
Chironomidae fam.	Chironomidae fam.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Corixidae fam.	Corixidae fam.			
Cryptochironomus spp.	Cryptochironomus spp.			
Cryptotendipes spp.	Cryptotendipes spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Drunella doddsii	A Mayfly			
Epeorus longimanus	A Mayfly			
Fallceon quilleri	A Mayfly			
Gomphus kurilis	Pacific Clubtail			
Hydroptila spp.	Hydroptila spp.			
Leptoceridae fam.	Leptoceridae fam.			
Libellula forensis	Eight-spotted Skimmer			
Nanocladius spp.	Nanocladius spp.			
Nectopsyche spp.	Nectopsyche spp.			
Pantala hymenaea	Spot-winged Glider			
Paratendipes spp.	Paratendipes spp.			
Polypedilum spp.	Polypedilum spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Tanytarsus spp.	Tanytarsus spp.			
Tricorythodes spp.	Tricorythodes spp.			

MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Gonidea angulata	Western Ridged Mussel		Special	
Helisoma spp.	Helisoma spp.			
Margaritifera falcata	Western Pearlshell		Special	
Physa spp.	Physa spp.			
PLANTS				
Castilleja campestris succulenta	Fleshy Owl's-clover	Threatened	Endangered	CRPR - 1B.2
Downingia pusilla	Dwarf Downingia		Special	CRPR - 2B.2
Neostapfia colusana	Colusa Grass	Threatened	Endangered	CRPR - 1B.1
Orcuttia pilosa	Hairy Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Tuctoria greenei	Green's Awnless Orcutt Grass	Endangered	Rare	CRPR - 1B.1
Alopecurus saccatus	Pacific Foxtail			
Arundo donax	NA			
Baccharis salicina				Not on any status lists
Bidens laevis	Smooth Bur-marigold			
Bidens tripartita	NA			
Brodiaea nana				Not on any status lists
Callitriche heterophylla heterophylla	Northern Water-starwort			
Callitriche marginata	Winged Water-starwort			
Cicendia quadrangularis	Oregon Microcala			
Cotula coronopifolia	NA			
Damasonium californicum				Not on any status lists
Downingia bella	Hoover's Downingia			
Downingia cuspidata	Toothed Calicoflower			
Downingia ornatissima	NA			
Eleocharis flavescens flavescens	Pale Spikerush			

Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Gratiola ebracteata	Bractless Hedge-hyssop			
Isoetes orcuttii	NA			
Juncus acuminatus	Sharp-fruit Rush			
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lemna gibba	Inflated Duckweed			
Lemna minor	Lesser Duckweed			
Lemna minuta	Least Duckweed			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limnanthes douglasii rosea	Douglas' Meadowfoam			
Lipocarpha micrantha	Dwarf Bulrush			
Mimulus latidens	Broad-tooth Monkeyflower			
Mimulus pilosus				Not on any status lists
Mimulus ringens	Square-stem Monkeyflower			
Mimulus tricolor	Tricolor Monkeyflower			
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Paspalum distichum	Joint Paspalum			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys austiniae	Austin's Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Potamogeton illinoensis	Illinois Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Psilocarphus tenellus	NA			
Rumex conglomeratus	NA			
Salix exigua exigua	Narrowleaf Willow			
Sidalcea hirsuta	Hairy Checker-mallow			
Symphyotrichum lentum	Suisun Marsh Aster		Special	CRPR - 1B.2

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

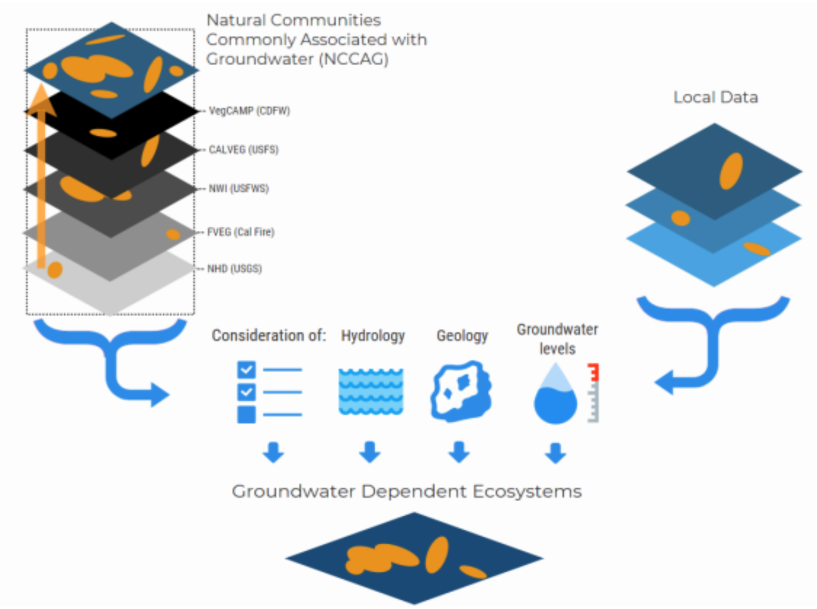


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

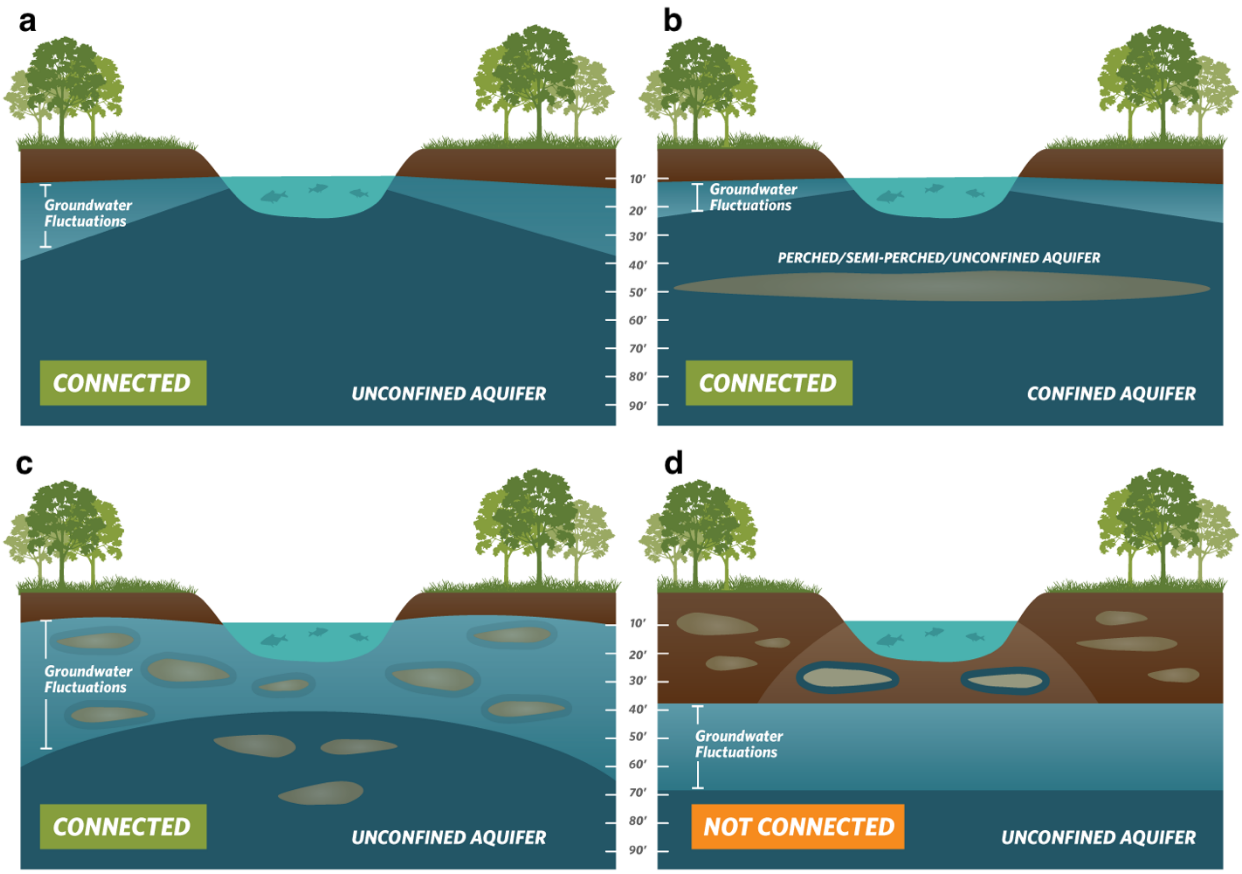

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

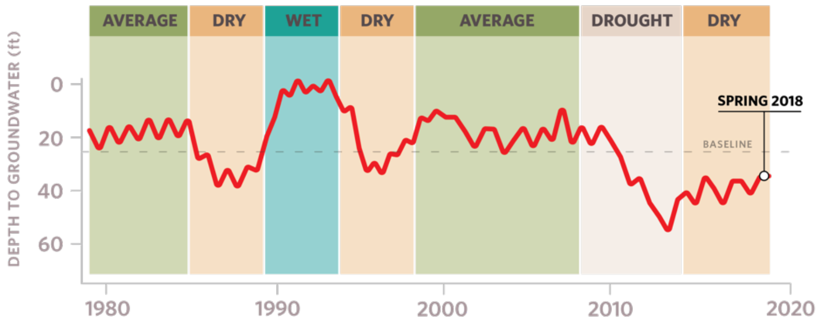

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

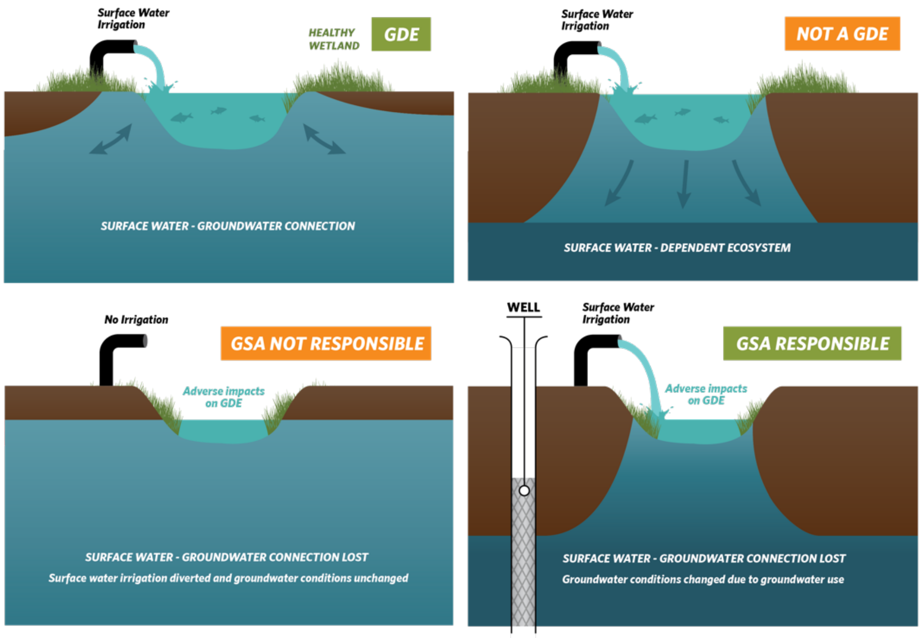

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

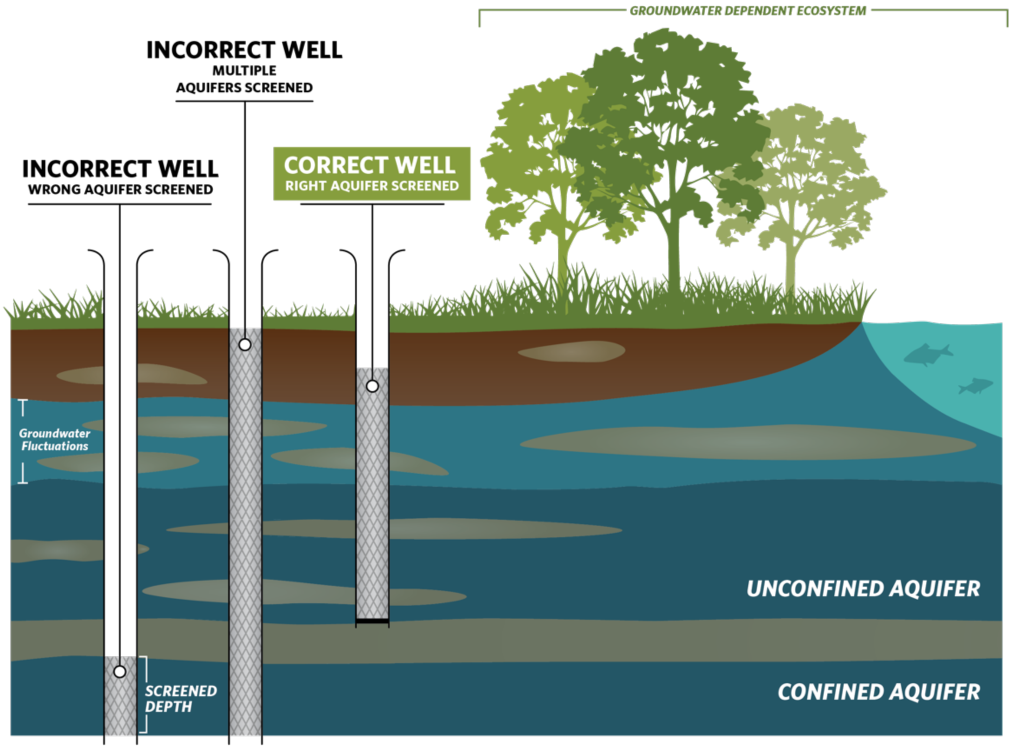

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

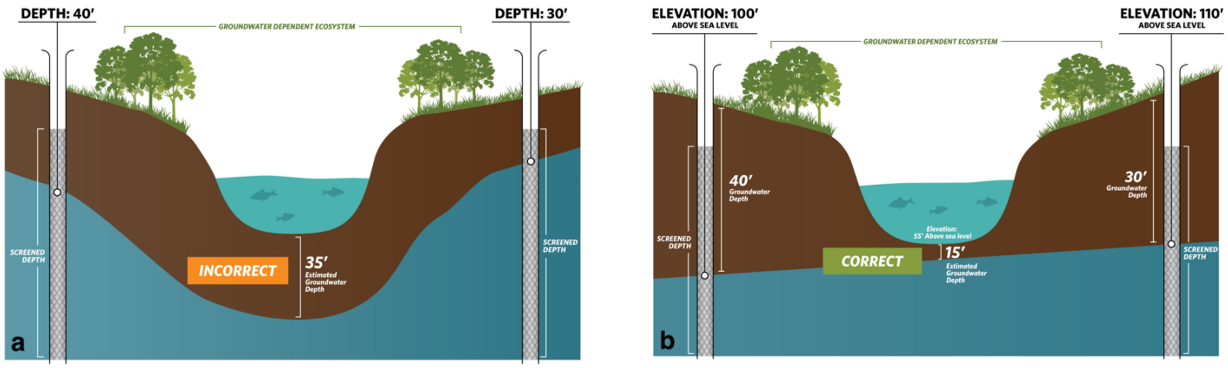

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

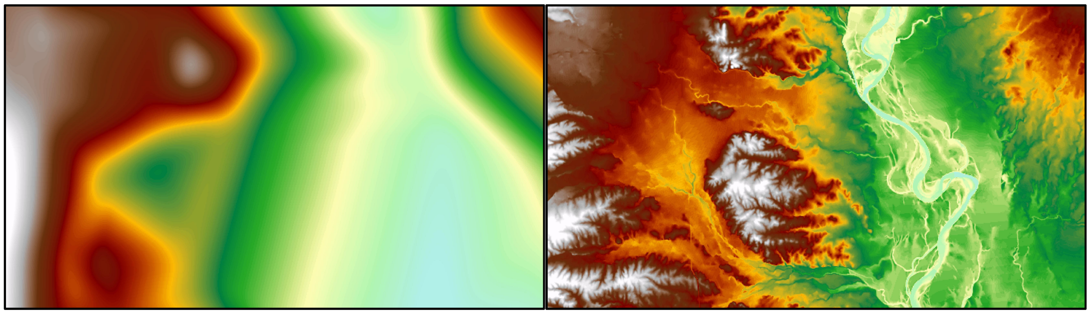

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

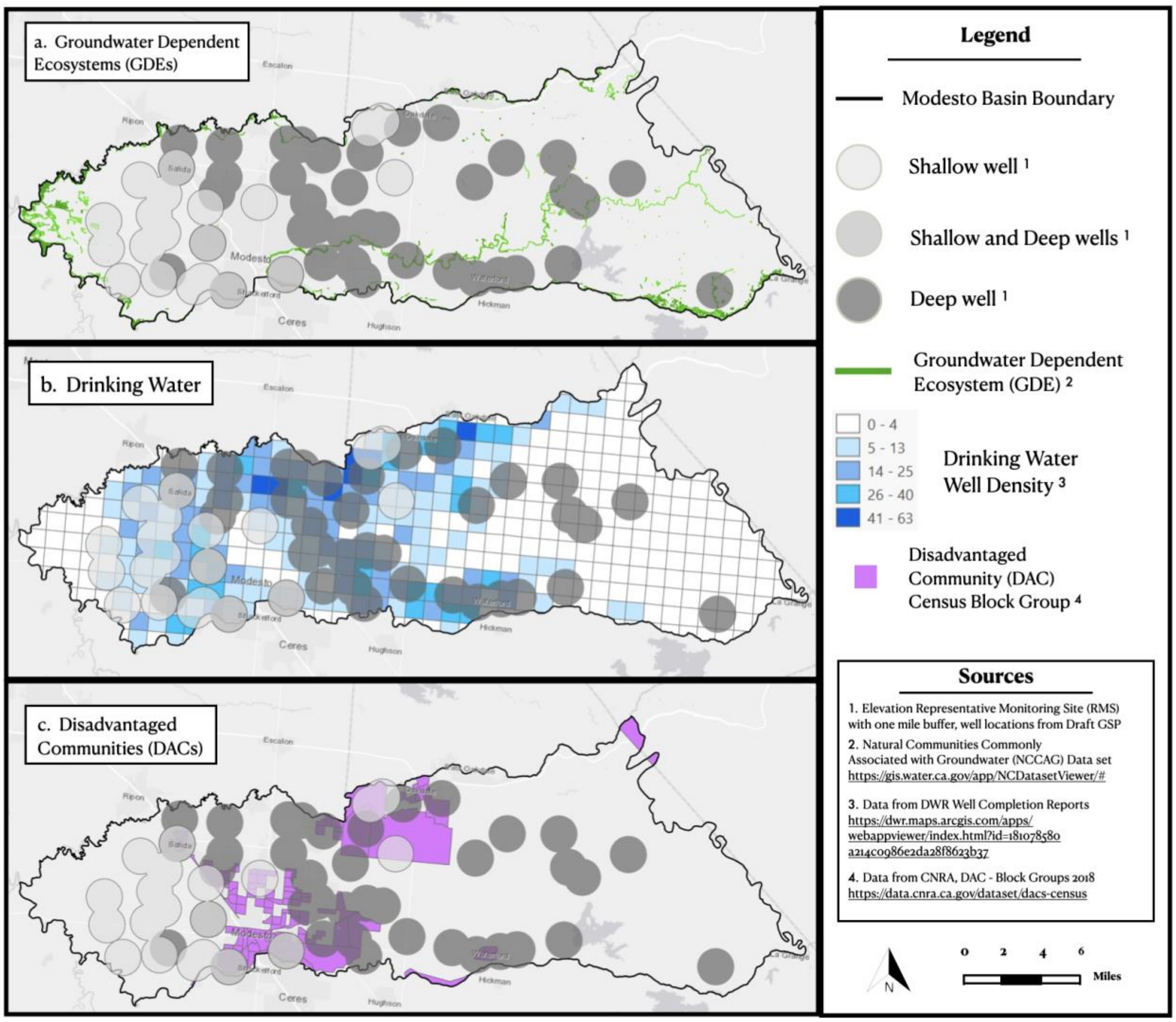

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

November 1, 2021

Salinas Valley Basin GSA
P.O. Box 1350
Carmel Valley, CA 93924

Submitted via web: https://form.jotform.com/201537036733047

Re: Public Comment Letter for Monterey Subbasin Draft GSP

Dear Donna Meyers,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Monterey Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Monterey Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

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Attachment A

Specific Comments on the Monterey Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users
The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP provides information on DACs, including identification by name and location on a map (Figure 1), and identifying the water source for DAC members. However, the GSP fails to clearly state the population of each DAC.

The GSP provides a density map of domestic wells in the subbasin (Figure 3-7). However, the plan fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide the population of each identified DAC. • Include a map showing domestic well locations and average well depth across the subbasin.

Interconnected Surface Waters
The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP does not present a map of interconnected stream reaches in the subbasin. Furthermore, the GSP does not show the location of groundwater wells or stream gauges in the subbasin, or provide description of temporal availability of groundwater data.

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[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

The GSP presents maps showing depth-to-groundwater contours for depths within 20 feet of the ground surface for two dates, fall 2017 and fall 2019. The GSP does not present an explanation of why 20 feet was chosen for the maximum depth shown on the contour maps. Furthermore, using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs. The use of two fall dates does not reflect the temporal (seasonal and interannual) variability inherent in California's climate.

RECOMMENDATIONS

- Describe available groundwater elevation data and stream flow data in the subbasin. ISWs are best analyzed using depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought), to determine the range of depth and capture the variability in environmental conditions inherent in California's climate.

- Provide a map of stream reaches in the subbasin. Overlay the stream reaches with full depth-to-groundwater contour maps (not just to 20 feet below ground surface) to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells in the subbasin used to create the contour maps.

- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

- On the map of stream reaches, consider any segments with data gaps as potential ISWs and clearly mark them as such. Describe data gaps for the ISW analysis. Reconcile these data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of supporting information provided for the GDE analysis. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). Additional local habitat management plans and studies were used to map GDEs located at the City of Marina coastal vernal ponds and Fort Ord wetlands. The GSP presents GDEs on Figure 5-37 and has retained all GDEs from these sources as potential GDEs in the GSP.

The GSP states (p. 5-68): *"These potential GDEs within the former Fort Ord are located within the federal land areas of the Subbasin not subject to SGMA."* However, SGMA states plans shall include "efforts to develop relationships with State and Federal regulatory agencies" [Water Code §10727.4(j)], and that "The federal government...may voluntarily agree to participate in the preparation and administration of a groundwater sustainability plan" [Water Code §10720.3(c)]. Finally, SGMA defines the federal government as a beneficial user of groundwater [Water Code §10723.2(g)]. Please include information on what steps were taken to address these requirements.

The GSP does not attempt to verify the NC dataset with groundwater data, however. While the GSP does acknowledge that shallow groundwater data in areas near GDEs is a data gap, no map is provided that shows the location of existing groundwater wells in the subbasin, or a description of spatial and temporal availability of existing groundwater data. Describing groundwater conditions within the basin's GDEs is an essential precursor to identifying data/monitoring gaps and evaluating potential effects on GDEs when establishing SMCs.

While the GSP discusses the vegetation communities at the City of Marina coastal vernal ponds observed during a site visit in June 2020, this is the only mention of vegetation communities within the subbasin's GDEs. The GSP does not provide further discussion or an inventory of the flora or fauna species present in the subbasin's GDEs or acknowledge endangered, threatened, or special status species in the subbasin.

RECOMMENDATIONS
● Discuss available shallow groundwater data. Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. ● Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape. ● Provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin (see Attachment C of this letter for a list of freshwater species located in the Monterey Subbasin). Note any threatened or endangered species. ● Provide further information about the steps taken to involve or collaborate with the federal government regarding potential GDEs located within the former Fort Ord area.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of native vegetation into the water budget is **insufficient**. The GSP text discusses evapotranspiration, but combines crop, urban, and native evapotranspiration in the discussion. Despite explicit mention that evapotranspiration is included in the Soil Moisture Budget (SMB) model, no evapotranspiration results for the land surface

[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

system are included in the GSP. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP and are not included in the water budgets.

RECOMMENDATION

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation and managed wetlands (if present).

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development

Stakeholder engagement during GSP development is **sufficient**. SGMA's requirement for public notice and engagement of stakeholders is fully met by the description in the Communications and Stakeholder Engagement section (Chapter 2).[4]

The GSA's outreach activities include an Advisory Committee including representation by underrepresented communities (URCs), rural residential well owners, and environmental stakeholders, Marina Coast Water District (MCWD) GSA Board Meetings, stakeholder workshops, and one-on-one meetings with interested parties.

Despite the outreach to DACs, there is no specific pathway for feedback from DAC residents and representatives to be considered and included in the GSP and its implementation.

We note specific engagement with DACs and environmental organizations during the GSP implementation process. The GSP states (p. 10-11): *"MCWD and SVBGSA's Stakeholder Communication and Engagement Plans (SCEPs) will continue to be refined, updated, and executed during GSP implementation."* These activities include subbasin planning committees transitioning to implementation committees , engaging residents of DACs during GSP implementation through engagement of MCWD customers and coordination with the City of Marina, and GSAs routine reporting to the public about GSP implementation and progress towards sustainability and needs for efficient groundwater use.

RECOMMENDATIONS

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- In the Communications and Stakeholder Engagement section, provide more information on how DACs and environmental stakeholders were included in the Advisory Committee and the role that it plays in GSP development.

- DAC and environmental stakeholder engagement should be improved by incorporating feedback and recommendations from DAC and environmental stakeholders engaged in the GSP process.

- Further describe efforts to engage with stakeholders during the GSP *implementation* phase in the Communications and Stakeholder Engagement section of the GSP. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the subbasin within the GSP.[5]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP discusses minimum thresholds impact on domestic wells (Section 8.7.3.2). The GSP states (p. 8-35): *"In the Corral de Tierra Area, 100% of the domestic wells should have at least 25 feet of water in them to remain operable if groundwater elevations are at minimum thresholds. Therefore, the minimum thresholds appear to be reasonably protective for domestic users.*" However, the analysis was only based on 19 wells out of the total 169 domestic wells in the OSWCR database. Furthermore, the GSP states (p. 8-35): *"Some domestic wells may draw water from shallow, perched groundwater that is not managed in this GSP.*" The GSP states (p. 4-36): *"There is one single principal aquifer in the Corral de Tierra Area called the El Toro Primary Aquifer System."* The shallow perched zones are part of the primary aquifer system and are still governed by the requirements of SGMA. The current analysis, which only considers 19 out of 169 wells, is insufficient and does not use best available information, for example including Public Land Survey System (PLSS) section location data, as was used in the 180/400 Foot Aquifer GSP.

[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

The GSP states (p. 8-20): *"Groundwater elevation minimum thresholds in the Corral de Tierra Area are defined as follows: Groundwater elevation observed in 2015 in the El Toro Primary Aquifer System."* The GSP does not describe or analyze the impact on DACs and domestic well owners to minimum thresholds that are set to drought-level groundwater elevations, nor does it describe how the existing groundwater level minimum thresholds will avoid significant and unreasonable impacts on DACs and domestic well users beyond 2015 and be consistent with Human Right to Water policy.[9]

For degraded water quality, the GSP identifies constituents of concern (COCs) within the subbasin in Table 8-5, which provides a list of constituents and number of wells that must exceed regulatory standards in order to trigger minimum thresholds. However, the GSP fails to provide justification for how those numbers were selected. The GSP also sets measurable objectives identical to minimum thresholds. The exceedance of minimum thresholds is supposed to trigger additional actions but since minimum thresholds in this plan are identified as measurable objectives, it is unclear what action is triggered. Furthermore, the regulatory standards are not explicitly provided in the GSP.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for chronic lowering of groundwater levels. For the analysis of minimum threshold impact on domestic wells, use best available information such as Public Land Survey System (PLSS) section location data.

- Establish minimum thresholds at the representative monitoring wells that account for the specific undesirable results the GSA has determined for the subbasin.

Degraded Water Quality

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[10]

- Set measurable objectives at lower levels than minimum thresholds (i.e., indicative of better water quality).

- Set concentration-based minimum thresholds and measurable objectives for COCs in the subbasin that are impacted by groundwater use and/or management. Ensure they align with drinking water standards.[11]

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3
[10] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.
[11] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts to GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC.

Sustainable management criteria for depletion of interconnected surface water are established by proxy using minimum shallow groundwater elevations historically observed between 1995 and 2015 near locations of interconnected surface water. To describe impacts to ecological surface water users, the GSP states (p. 8-76): *"There are no known flow prescriptions on the El Toro Creek or any tributaries in the Corral de Tierra Area. Therefore, the current level of depletion has not violated any ecological flow requirements. This conclusion is not meant to imply that depletions do not impact potential species living in or near surface water bodies in the Corral de Tierra Area. However, any impacts that may be occurring have not risen to a level that triggers regulatory intervention. Therefore, the impacts from current rates of depletion on ecological surface water users adjacent to the El Toro Creek are not unreasonable."* The GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin.[12] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[13]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when

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[12] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[13] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

minimum thresholds in the subbasin are reached.[14] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,15]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[16] The effects of climate change can intensify the impacts of water stress on GDEs, making available shallow groundwater resources more critical for their survival. Research shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[17] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems and domestic well owners.

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[14] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[15] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[16] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[17] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

The GSP states that climate change is incorporated into key inputs (e.g., precipitation, evapotranspiration, surface water flow, and sea level rise) of the projected water budget. However, we were unable to confirm this since Appendix 6B (Monterey Subbasin Groundwater Flow Model Documentation) was not available at the time of the Draft GSP's publication.

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Provide details in the GSP on how climate change was incorporated into key inputs (e.g., precipitation, evapotranspiration, surface water flow, and sea level rise) of the water budget.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions around DACs and domestic wells and shallow groundwater elevations around GDEs and ISWs in the subbasin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[18]

Figure 7-1 through Figure 7-6 show the locations of the groundwater elevation monitoring network and wells selected for the RMS network within the Marina-Ord Area and the Corral De Tiera Area. Refer to Attachment E for maps of these monitoring sites, plotted by depth, in relation to key beneficial users of groundwater. The monitoring network that represents shallow groundwater elevations around DACs and domestic wells in the subbasin appears sufficient in terms of spatial and depth distribution.

Figure 7-17 (Locations of Wells in the Groundwater Quality Monitoring Network) shows that no water quality monitoring wells are located across portions of the subbasin near DACs and domestic wells. The monitoring network that represents water quality conditions around DACs and domestic wells in the subbasin is insufficient in terms of spatial and depth distribution. Note we were unable to create a map of water quality RMSs since Appendix 7F was not available at the time of the Draft GSP's publication.

The GSP discusses plans to install a new shallow monitoring well in the Corral de Tierra Area to assess ISWs. The GSP does not, however, discuss plans to fill data gaps for GDEs, despite acknowledging significant GDE data gaps in the GDE section of the GSP.

RECOMMENDATIONS

[18] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, GDEs, and ISWs to clearly identify potentially impacted areas.
- Increase the number of RMSs in the shallow aquifer across the subbasin as needed to adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, and GDEs when identifying new RMSs.
- Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.
- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient** due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

Section 9.4.3 documents the Multi-benefit Stream Channel Improvements and discusses its benefits including groundwater recharge. However, the project is described as a potential project that will be implemented on an as-needed basis and the GSP does not explicitly define a planning horizon within the SGMA process.

In Section 9.5.9 (Dry Well Notification System), the GSP states (p. 9-104): "*The GSA could develop or support the development of a program to assist well owners (domestic or state small and local small water systems) whose wells go dry due to declining groundwater elevations."* The GSP states that the program could involve a notification system, monitoring triggered by lowered groundwater elevations, public outreach, "*...referral to assistance with short-term supply solutions, technical assistance to assess why it went dry, and/or long-term supply solutions*." However, no further specifics on a drinking water well impact mitigation program are provided.

RECOMMENDATIONS

- For DACs and domestic well owners, provide specific plans for implementation of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSAs plans to mitigate such impacts.

- Clarify the planning horizon of the described multi-benefit stream channel improvements to ensure that the project will proactively provide groundwater recharge, remove invasive species, and reduce streamflow impediments through GSP implementation.

- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document".[19]

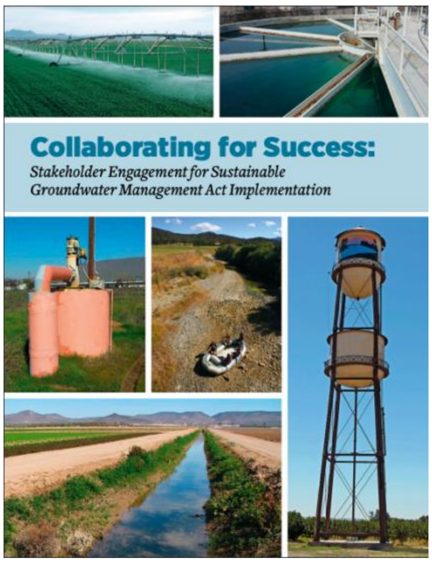
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[19] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



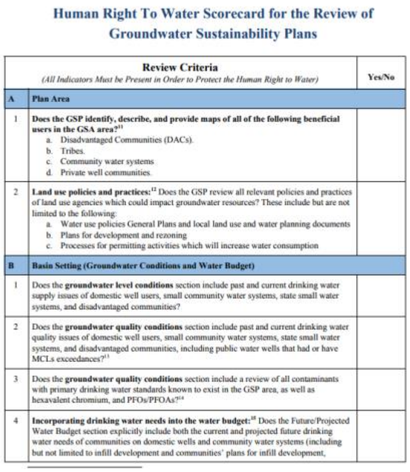
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

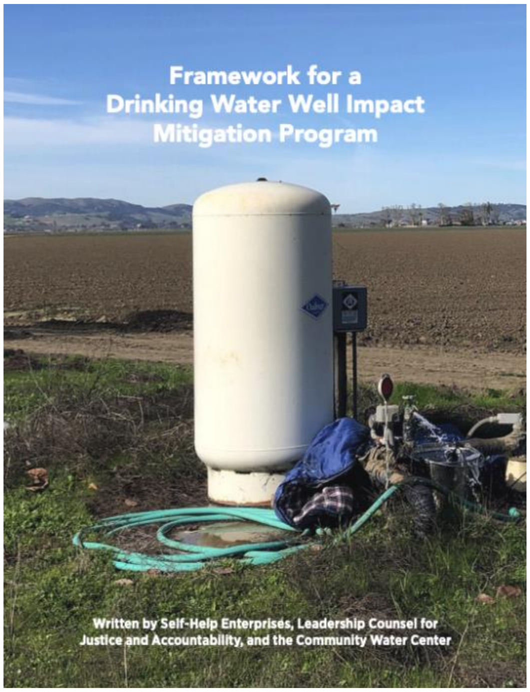
The Human Right to Water


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

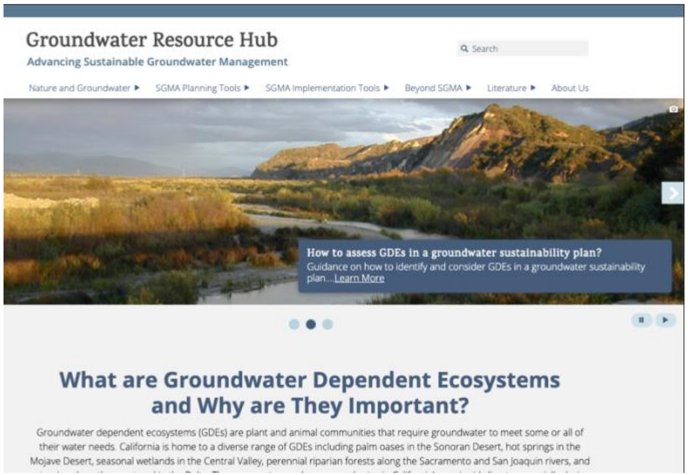
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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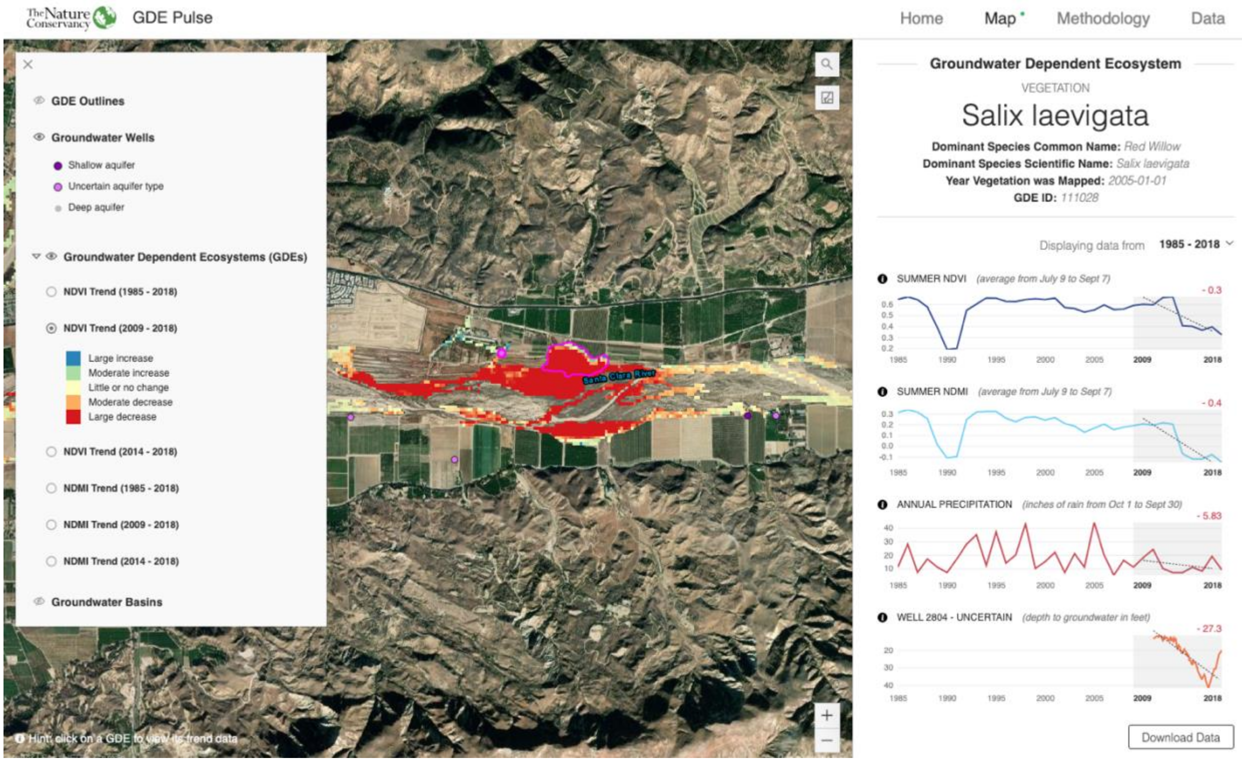
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

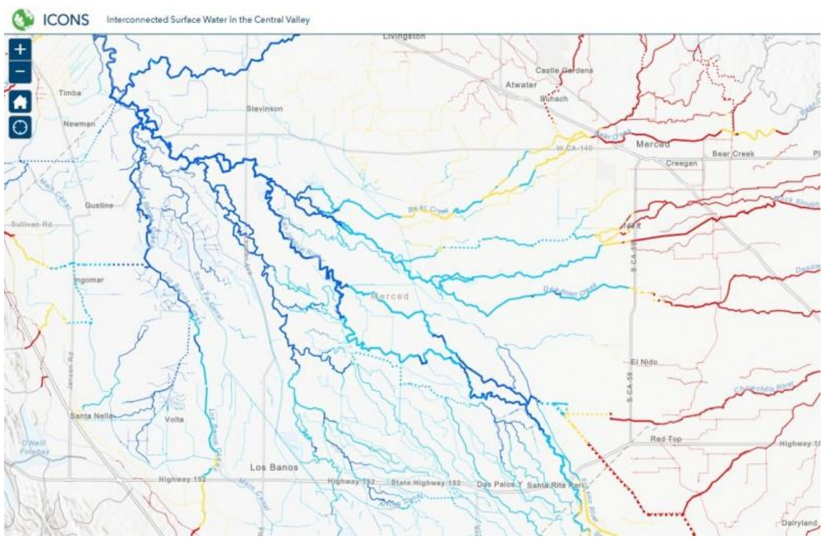
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Monterey Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Monterey Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			

1 Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

2 California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

3 Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
CRUSTACEANS				
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
FISH				
Oncorhynchus mykiss - SCCC	South Central California coast steelhead	Threatened	Special Concern	Vulnerable - Moyle 2013

HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Anaxyrus boreas halophilus	California Toad			ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
Pseudacris sierra	Sierran Treefrog			
INSECTS & OTHER INVERTS				
Enallagma civile	Familiar Bluet			
Libellula pulchella	Twelve-spotted Skimmer			
Sympetrum corruptum	Variegated Meadowhawk			
PLANTS				
Lasthenia conjugens	Contra Costa Goldfields	Endangered	Special	CRPR - 1B.1
Alopecurus saccatus	Pacific Foxtail			
Arundo donax	NA			
Baccharis glutinosa	NA			Not on any status lists
Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche heterophylla heterophylla	Northern Water-starwort			
Callitriche marginata	Winged Water-starwort			
Calochortus uniflorus	Shortstem Mariposa Lily		Special	CRPR - 4.2
Cicendia quadrangularis	Oregon Microcala			
Cicuta maculata bolanderi	Bolander's Water-hemlock		Special	CRPR - 2B.1
Cotula coronopifolia	NA			

Crassula aquatica	Water Pygmyweed			
Crypsis vaginiflora	NA			
Datisca glomerata	Durango Root			
Elatine brachysperma	Shortseed Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Euthamia occidentalis	Western Fragrant Goldenrod			
Isoetes howellii	NA			
Isoetes orcuttii	NA			
Juncus falcatus falcatus	Sickle-leaf Rush			
Juncus phaeocephalus paniculatus	Brownhead Rush			
Juncus phaeocephalus phaeocephalus	Brown-head Rush			
Juncus rugulosus	Wrinkled Rush			
Juncus uncialis	Inch-high Rush			
Legenere limosa	False Venus'-looking-glass		Special	CRPR - 1B.1
Marsilea vestita vestita	NA			Not on any status lists
Navarretia intertexta	Needleleaf Navarretia			
Persicaria amphibia				Not on any status lists
Phacelia distans	NA			
Pilularia americana	NA			
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pogogyne douglasii	NA			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus tenellus	NA			
Ranunculus lobbii	Lobb's Water Buttercup		Special	CRPR - 4.2
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rumex salicifolius salicifolius	Willow Dock			
Salix lasiolepis lasiolepis	Arroyo Willow			
Stachys ajugoides	Bugle Hedge-nettle			
Triglochin scilloides	NA			Not on any status lists
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	NA			
Veronica catenata	NA			Not on any status lists

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

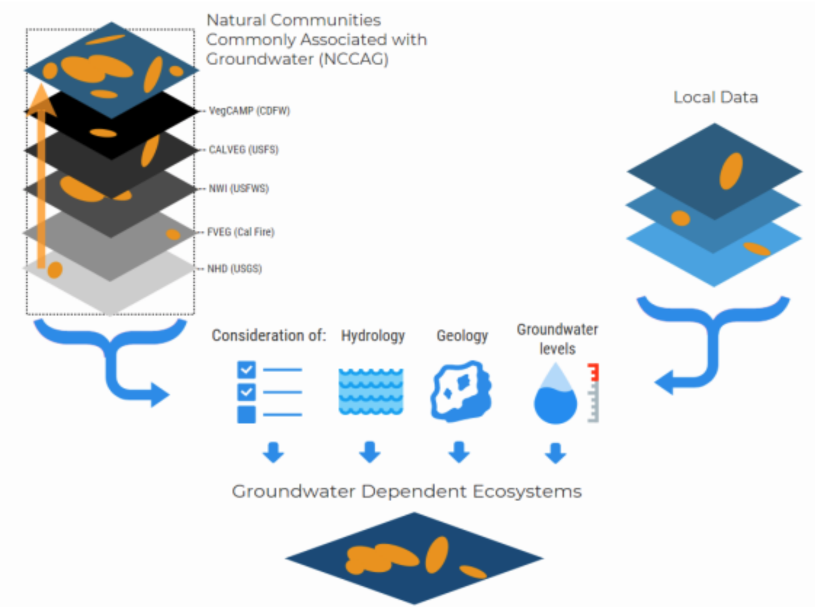


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

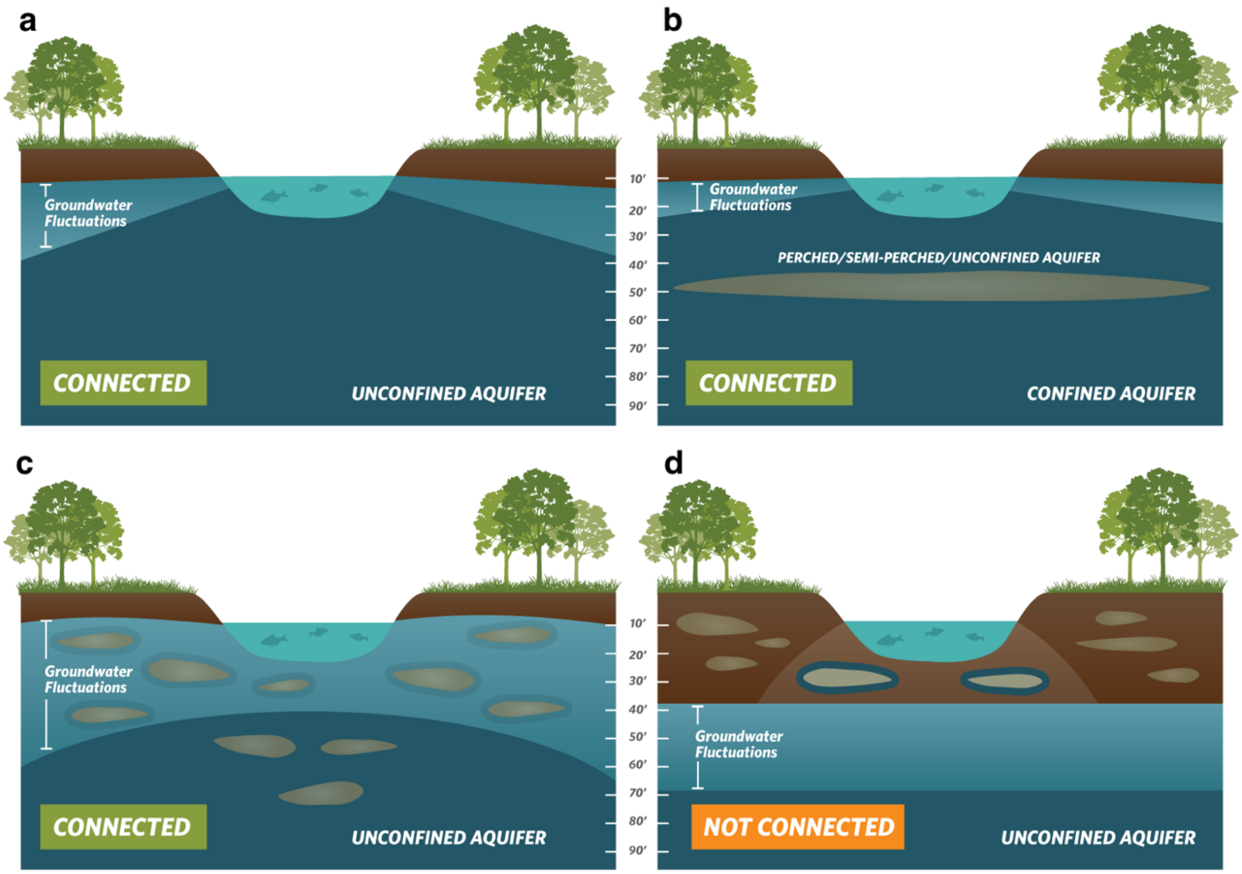

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

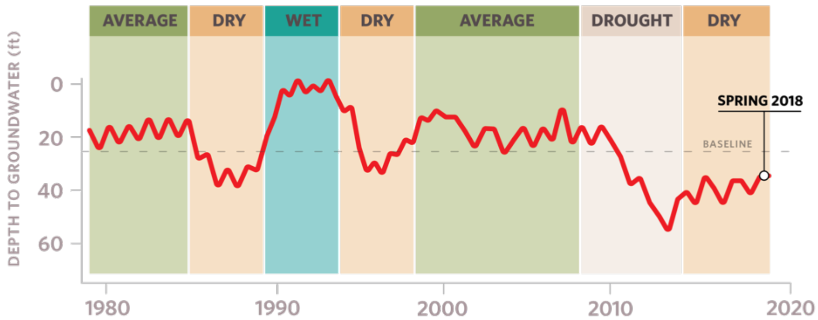

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

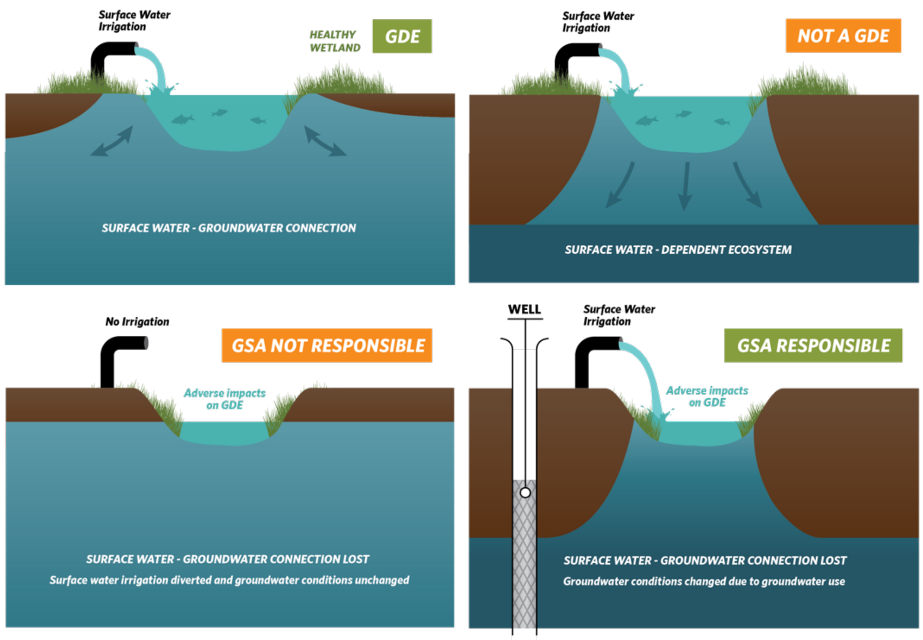

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

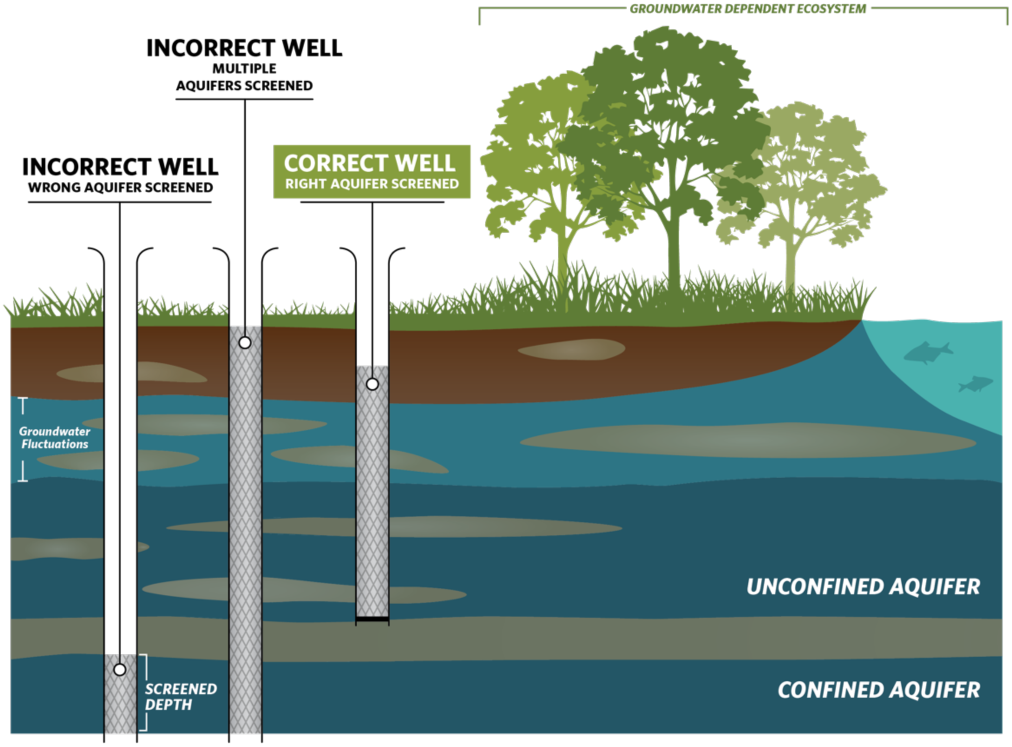

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

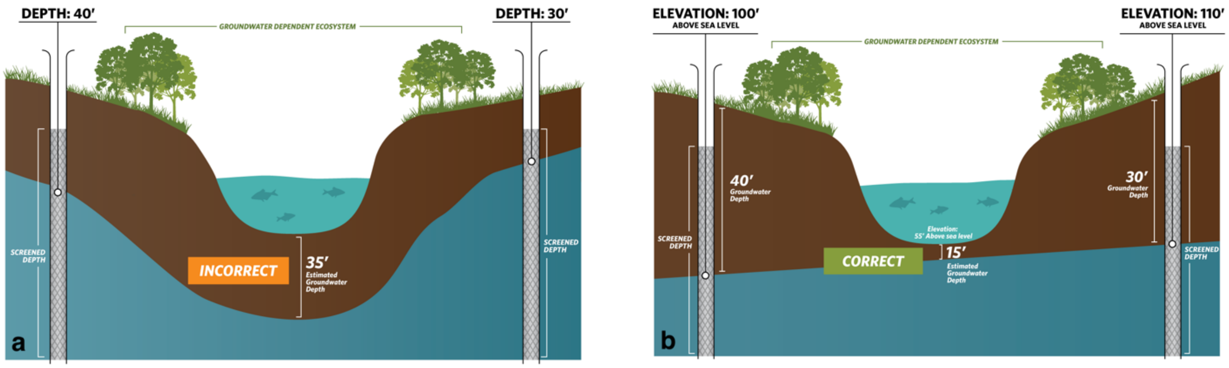

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

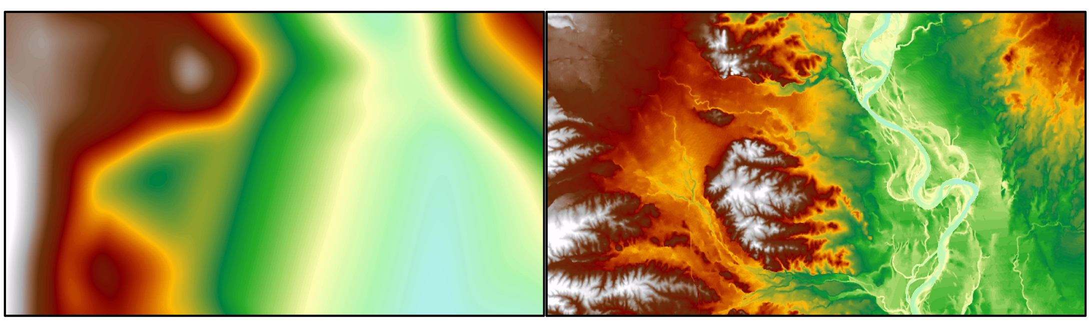

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

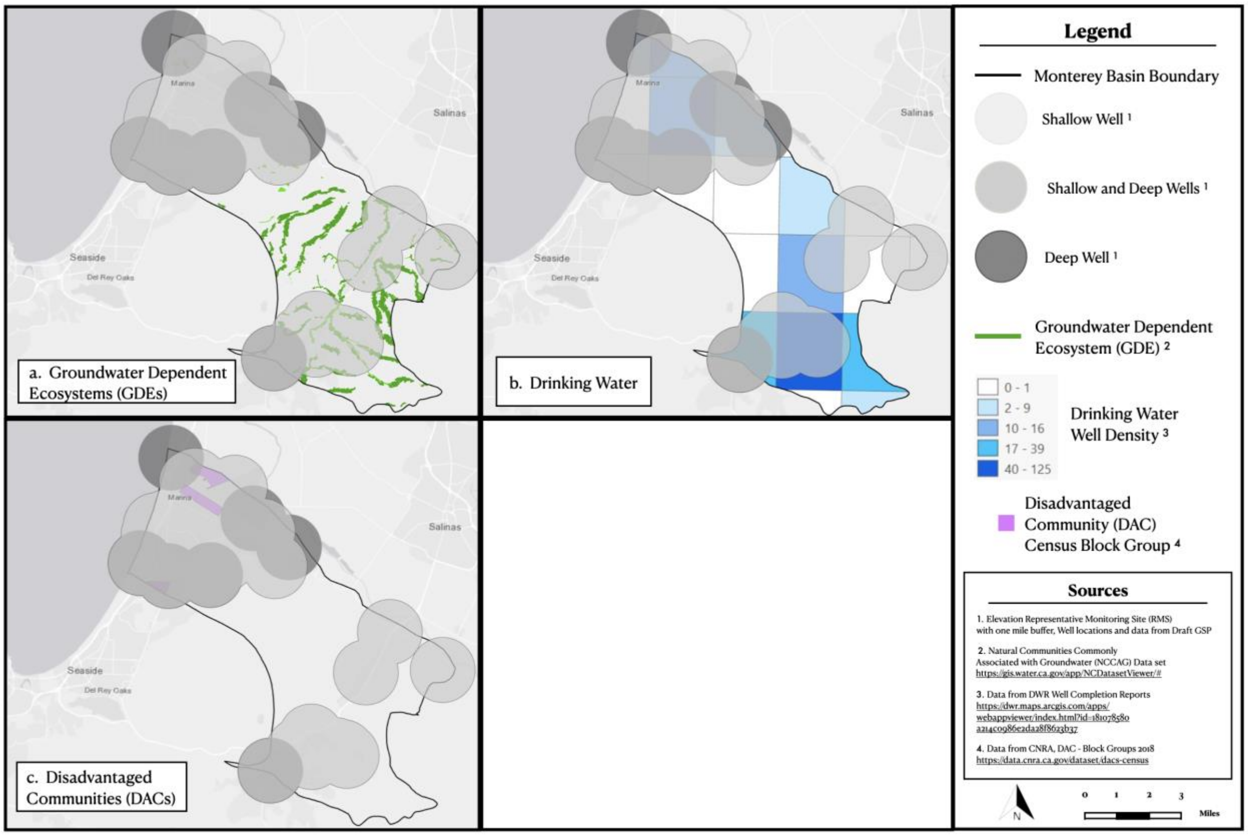

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

August 23, 2021

Mound Basin GSA
P.O. Box 3544
Ventura, CA 93006-3544
Submitted via email: jackiel@unitedwater.org.

Re: Public Comment Letter for the Mound Groundwater Basin Draft GSP

Dear Bryan Bondy,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Mound Groundwater Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Mound Groundwater Basin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Mound Groundwater Basin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. We note the following deficiencies with the identification of these key beneficial users.

- The GSP provides a map of DAC block groups and DAC tracts within the basin (Figure 1 in Appendix D) but does not include any other identifying information for DACs.
- The adopted Stakeholder Engagement Plan (Appendix D) states that there are domestic wells overlying the basin; however, the main body of the GSP states that there are no domestic wells within the basin due to availability of potable water from Ventura Water. The GSP does not provide the location and depth of the domestic wells within the basin, nor does it provide a well density map of domestic wells in the basin. Additionally, the GSP fails to identify the population dependent on groundwater as their source of drinking water in the basin.
- The GSP states that portions of the Barbareno-Ventureno Band of Chumash are located within the Mound Basin, but does not include a map of tribal areas within the basin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, to support the development of water budgets using the best available information, and to support the development of sustainable management criteria and projects and management actions (PMAs) that are protective of these users.

RECOMMENDATIONS
• Provide clarification on the status of domestic wells within the basin. DWR Well Completion Report Map[1] shows that there are some domestic wells within the basin. Include a map showing the domestic wells in the basin by location and depth. even if they are not currently in use. Wells previously in use may have been impacted by poor water quality or declining groundwater elevations. • Provide an estimate of the population dependent on groundwater within the Mound Basin. The GSP states that "The City of Ventura (Ventura Water) serves the areas indicated by DWR as Disadvantaged Communities (DACs) and Severely Disadvantaged

[1] DWR Well Completion Report Map
https://dwr.maps.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37

Communities (SDACs)." The GSP does not, however, currently provide clear information on how and to what extent DAC members rely on groundwater.

- Include a map of tribal lands within the basin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**. ISWs were inadequately dismissed based on the incorrect assertion that the shallow aquifer is not a principal aquifer, despite the recognition in the Basin Setting section of the GSP that there is a likely connection between shallow groundwater and surface water. Groundwater in the shallow aquifer is likely providing baseflow to the Santa Clara River in this basin. The GSP states on p. 51: "In addition to groundwater production from the principal aquifers, discharge of small quantities of groundwater from the shallow alluvial aquifer to the lower reach of the Santa Clara River and possibly one other area in Mound Basin may contribute to groundwater-dependent ecosystems (GDEs)." SGMA defines principal aquifers as "aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems" [23 CCR § 351 (aa)].

The GSP states that it is unknown whether there is a connection between the shallow and underlying principle aquifers in the basin. Even if pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers that can support springs, surface water, and groundwater dependent ecosystems. This is because the goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits, and while groundwater pumping may not be currently occurring in a shallow aquifer, it could be in the future.

The GSP states on p. 67: "Data are not available to characterize the interconnection of Santa Clara River surface water and groundwater. Although the frequent perennial baseflow conditions imply that surface and groundwater is interconnected, it is not known specifically which groundwater in which units are connected and where." However, the GSP should not ignore ISWs just because there is a lack of data to support their characterization. The absence of evidence is not the evidence of absence. Therefore, potential ISWs are not being identified, described, nor managed in the GSP. Until a disconnection can be proven, include all potential ISWs in the GSP. This is necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water.

RECOMMENDATIONS

- Include the shallow groundwater system as a principal aquifer in this GSP to ensure adequate monitoring and management of this critical groundwater resource for current and future beneficial users.

- Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs.
- Reconcile ISW data gaps with specific measures (shallow monitoring wells (especially in the shallow aquifer), stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources. However, we found that mapped features in the NC dataset were improperly disregarded, as described below.

- The GSP uses the same incorrect rationale used in the ISW section to state that GDEs are not present in the Basin because they do not rely on groundwater from a principal aquifer. As noted above, GSP Regulations define principal aquifers as "aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems" [23 CCR §351(aa)] regardless of pumping rates. Shallow aquifers that have the potential to support well development, support ecosystems, or provide baseflow to streams are principal aquifers, even if the majority of the basin's pumping is occurring in deeper principal aquifers. If there are no data to characterize groundwater conditions in the shallow principal aquifer, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP.
- GDEs were incorrectly removed in areas adjacent to irrigated fields due to the presence of surface water. However, GDEs can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields - simultaneously and at different temporal/spatial scales. NC dataset polygons adjacent to irrigated land can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to irrigated fields.

RECOMMENDATIONS

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.
- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.
- In addition to providing maps of the vegetation and wetland communities from the NC dataset in the GSP area (as provided in Appendix G of the GSP), please also provide an inventory, map, or description of fauna (e.g., birds, fish, amphibian) species in the basin and note any threatened or endangered species. See Attachment C of this letter for a list of freshwater species located in the Mound Basin.

Native Vegetation

Native vegetation is a water use sector that is required[2,3] to be included into the water budget. The integration of this ecosystem into the water budget is **insufficient**. The water budget did not include the current, historical, and projected demands of native vegetation. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

RECOMMENDATION
• Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders[4] is not fully met by the description in the Stakeholder Engagement Plan included in the GSP (Appendix D).

We acknowledge and commend the clear description of the inclusion of an environmental stakeholder on the governing board of the GSA. The Environmental Stakeholder Director is responsible for engaging environmental stakeholders within the Basin and representing environmental interests before the GSA, including during GSP implementation. However, the engagement plan describes only a minimum amount of outreach to DACs. Stakeholder engagement has primarily occurred via Ventura Water bill stuffers and newsletters, including materials provided in Spanish. Noted deficiencies in the stakeholder engagement process include:

- As the water supplier for DACs in the Basin, the City represented DAC interests through its participation on the MBGSA Board of Directors. However, it does not give more information about how their interests were represented.
- The opportunities for public involvement and engagement are limited to MBGSA regular board meetings, review of the MBGSA's website, and providing comments via the website.
- The GSP states that the GSA "has held several public workshops to provide in-depth discussion of the GSP and obtain stakeholder feedback. The workshops include polls to help facilitate public input on key issues and identify which outreach methods are most

[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

effective." The GSP gives no further information about how the workshops were advertised or if DACs were engaged to attend.

- The GSP states that portions of the Barbareno-Ventureno Band of Chumash are located within the Mound Basin and the MBGSA will inform the Tribal Elder, Julie Tumamait, throughout the GSP development process and GSP implementation.However, there are no further details on the engagement with the tribe.
- Domestic well owners are specifically mentioned in the Stakeholder Engagement Plan as holders of overlying groundwater rights, however no information is provided other than stating that their participation is invited in the Agency's public meetings.
- The Stakeholder Engagement Plan does not include a plan for continual opportunities for engagement through the implementation phase of the GSP for DACs.

RECOMMENDATIONS

- Include a more detailed and robust Stakeholder Engagement Plan that details how the GSA will actively target and engage DAC community members during the remainder of the GSP development process and throughout the GSP implementation phase. Include plans to directly engage the DAC population for inclusion on the Board of Directors instead of having DACs represented by the City of Ventura. Refer to Attachment B for specific recommendations on Stakeholder Communication and Engagement.

- Conduct outreach at frequented locations such as farmers markets and schools across the plan area, providing translation services and technical assistance where needed. Refer to Attachment B for specific recommendations on how to actively engage community stakeholders.

- Consult and engage with the Barbareno-Ventureno Band of Chumash Tribe. Refer to "DWR guidance for engagement with tribal governments" for specific guidance.[5]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[6] and establishing minimum thresholds[7,8]

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[5] DWR guidance on Engagement with Tribal Governments
https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Disadvantaged Communities and Drinking Water Users

The GSP states that the City of Ventura (Ventura Water) serves DAC communities in the basin. It also states that there are domestic wells in the basin, but that the majority of these domestic well owners are *de minimus* users. It does not provide the location of the domestic wells, the screened interval, or the most recent reported date of well usage. Because the location of domestic wells is not provided in the GSP, the impacts to the domestic well user population are unknown. Because the GSP has not established SMC for the shallow principal aquifer, the GSP neither describes nor analyzes direct or indirect impacts on DACs or domestic drinking wells when defining undesirable results for chronic lowering of groundwater levels or water quality. Therefore, the SMC provided in the GSP are not protective of domestic drinking water well users.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Establish chronic lowering of groundwater level SMC for the shallow principal aquifer that are protective of DACs and domestic well users. Even though the shallow principal aquifer is not currently pumped or treated for domestic drinking water, it could be in the future.
- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users within the basin.

Degraded Water Quality

- Establish water quality SMC for the shallow principal aquifer that are protective of drinking water users. Even though the shallow principal aquifer is not currently pumped or treated for domestic drinking water, it could be in the future.
- Establish minimum thresholds at the representative monitoring wells that avoid the specific undesirable result of impacting water quality for potable use. For each of the two deep principal aquifers, the GSP states that undesirable results occur when all representative monitoring wells in a principal aquifer exceed the minimum threshold concentration for a constituent for two consecutive years. Because the minimum thresholds are set to the MCL, or in some cases higher than the Secondary MCL (see Table 4.1-02), this does not appear to satisfy the stated minimum threshold goal of protecting water quality for potable uses.
- Evaluate the cumulative or indirect impacts of proposed minimum thresholds on drinking water users, including domestic wells and municipal water suppliers. The GSP states that potential effects on municipal beneficial uses would be increased costs for treatment or blending to meet drinking water standards, however this is the only impact discussed.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Because the shallow aquifer is disregarded as a principal aquifer in the GSP, sustainable management criteria provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater or surface water when defining undesirable results. This is problematic because without identifying potential impacts to GDEs and beneficial users of interconnected surface waters, minimum thresholds may compromise, or even irreparably destroy, environmental beneficial users. Since potential GDEs are present in the basin, they must be considered when developing SMC for the basin. The comments above provide recommendations for re-evaluating the extent of GDEs and ISW in the basin by first considering the shallow aquifer as a principal aquifer.

RECOMMENDATIONS

- Establish SMC for the shallow principal aquifer that are protective of environmental uses and users. When defining undesirable results for chronic lowering of groundwater levels, water quality, and depletions of interconnected surface waters, please provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[9] in the basin. Defining undesirable results is the crucial first step before the minimum thresholds[10] can be determined.

- For the interconnected surface water SMC, the undesirable results should include a description of potential impacts on instream habitats within ISWs when defining minimum thresholds in the basin[11]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP (See Attachment C for a list of freshwater species in your basin). These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,12].

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[13] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the GSP did not consider the 2070 extremely wet and extremely dry climate scenarios in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and

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[9] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[10] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[11] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[12] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[13] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

We acknowledge and commend the inclusion of climate change into key inputs (precipitation, evaporation, surface water flow, and sea level inputs) of the projected water budget. Additionally, the sustainable yield is calculated based on the projected pumping for all three future projections (baseline, 2030, and 2070). However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems and domestic well owners.

RECOMMENDATIONS

- Integrate extreme wet and dry scenarios into the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Climate change was addressed when describing the minimum threshold for seawater intrusion. We recommend incorporating climate change considerations into other projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**. Our comments above note that the principal shallow aquifer was disregarded in the GSP. The lack of monitoring wells in the shallow aquifer and/or the lack of plans for future monitoring threatens GDEs, aquatic habitats, surface water users and shallow domestic well water. Potential GDEs are located in areas of the subbasin where no shallow groundwater monitoring currently exists or is proposed, leaving data gaps unfilled. Potential ISWs have been dismissed in the GSP, without proposed recommendations to improve ISW identification, mapping, and estimates of depletions. Appropriate monitoring is necessary so that groundwater conditions within GDEs and ISWs are characterized and surface-shallow groundwater interactions are fully integrated into the GSP.

Without adequate monitoring and identification of data gaps in the shallow aquifer, GDEs, ISWs, DACs, and domestic well users will remain unprotected by the GSP. The Plan therefore fails to meet SGMA's requirements for the monitoring network[14].

[14] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

RECOMMENDATIONS

- Include representative monitoring sites (RMSs) in the shallow principal aquifer across the basin for all groundwater condition indicators. The GSP states that water quality in the shallow principal aquifer is poor, but provides no monitoring data. Prioritize proximity to GDEs and domestic wells when identifying new RMPs.
- Provide maps that overlay monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify potentially impacted areas.
- Evaluate how the gathered data will be used to identify and map GDEs and ISWs, and to identify DACs and shallow domestic well users that are vulnerable to undesirable results.
- Determine what ecological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**. The GSP states there is no need for project and management actions to address gaps between current and projected sustainable yield. However, groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for all beneficial users. These beneficial users such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users were not sufficiently identified in the GSP. Therefore, potential project and management actions have not been designed or proposed to protect these vulnerable users of the shallow principal aquifer.

RECOMMENDATIONS

Because GDEs, aquatic habitats, surface water users, DACs, and shallow domestic well water users were not sufficiently identified in the GSP, please consider including the following related to potential project and management actions in the GSP:

- For GDEs and ISWs, recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[15].

[15] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

- For DACs, monitor the impacts of projects and management actions on communities and drinking water users. For example, provide locations of the improperly constructed or abandoned wells, as discussed in Section 6.5, that create conduits for migration of poor-quality water from shallow water-bearing units into the principal aquifers. Discuss how sealing these wells will benefit DACs and domestic wells users.

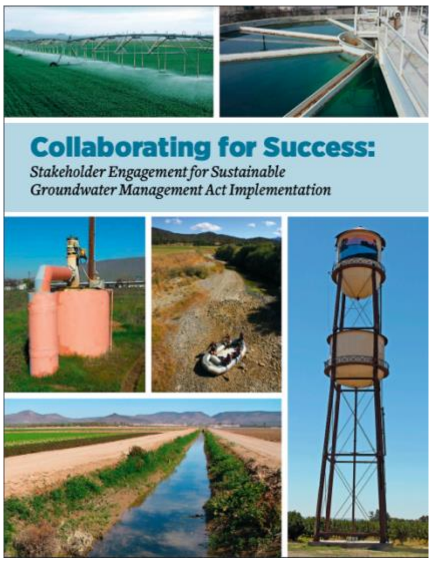
- For DACs and domestic well owners, take a full accounting of the locations and screened intervals of domestic wells in the basin, even those with de minimus use. Implement a drinking water well mitigation program to protect drinking water users.

- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

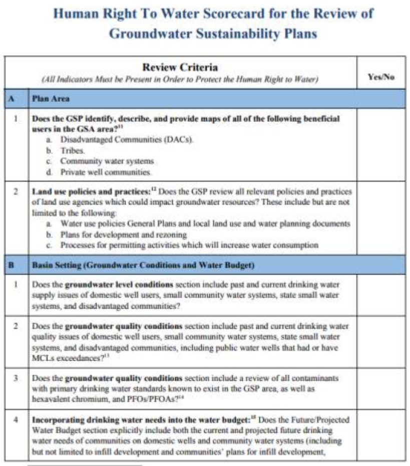
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

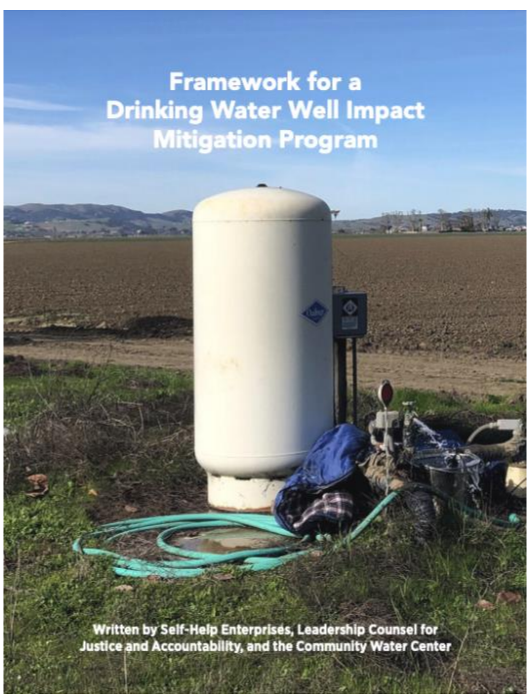


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

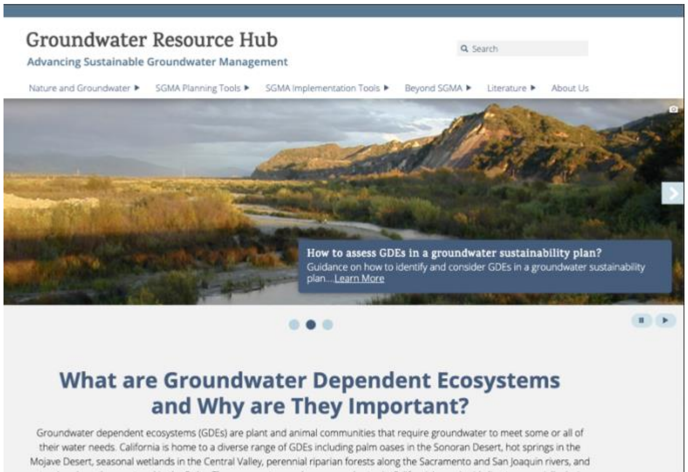
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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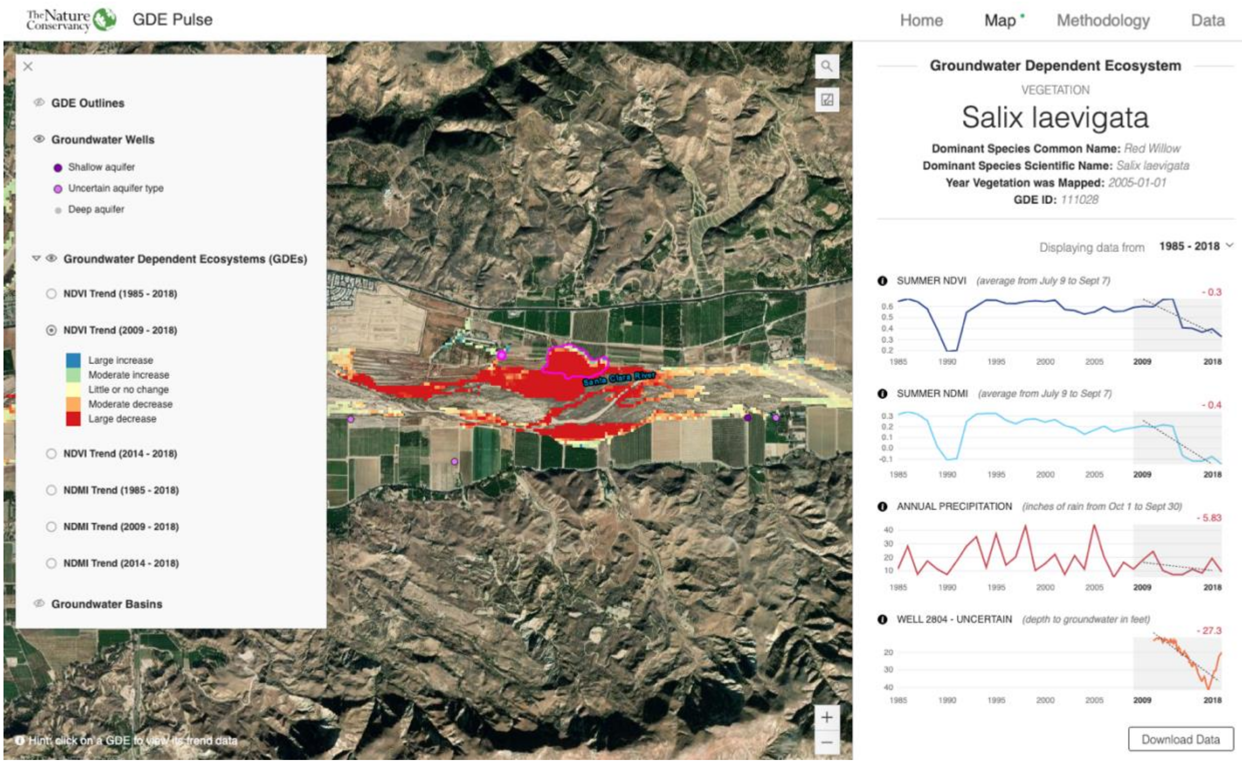
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](https://gde.codefornature.org) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

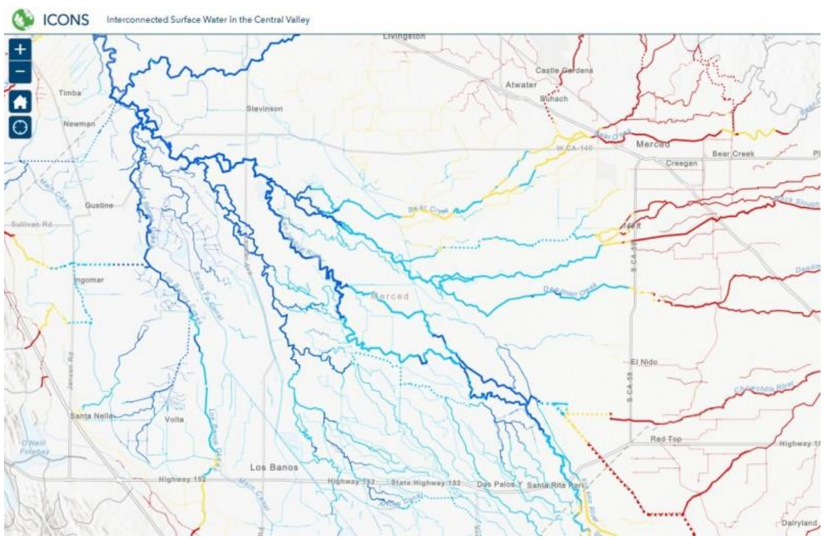
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Mound Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", this attachment provides a list of freshwater species located in the Mound Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			

Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Rynchops niger	Black Skimmer			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Vireo bellii	Bell's Vireo			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Hyalella spp.	Hyalella spp.			
FISH				
Eucyclogobius newberryi	Tidewater goby	Endangered	Special Concern	Vulnerable - Moyle 2013
Oncorhynchus mykiss - Southern CA	Southern California steelhead	Endangered	Special Concern	Endangered - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Pseudacris cadaverina	California Treefrog			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC

Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Apedilum spp.	Apedilum spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Cricotopus spp.	Cricotopus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Enochrus carinatus				Not on any status lists
Ephydridae fam.	Ephydridae fam.			
Eukiefferiella spp.	Eukiefferiella spp.			
Micropsectra spp.	Micropsectra spp.			
Paracladopelma spp.	Paracladopelma spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Pentaneura spp.	Pentaneura spp.			
Polypedilum spp.	Polypedilum spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Simulium donovani				Not on any status lists
Simulium spp.	Simulium spp.			
Simulium tescorum				Not on any status lists
MOLLUSKS				
Physa spp.	Physa spp.			
Physella cooperi	Olive Physa			V
PLANTS				
Arundo donax	NA			
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Datisca glomerata	Durango Root			
Ludwigia peploides peploides	NA			Not on any status lists
Lythrum californicum	California Loosestrife			
Phyla nodiflora	Common Frog-fruit			

Platanus racemosa	California Sycamore			
Potentilla anserina pacifica				Not on any status lists
Salix lasiandra lasiandra				Not on any status lists

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

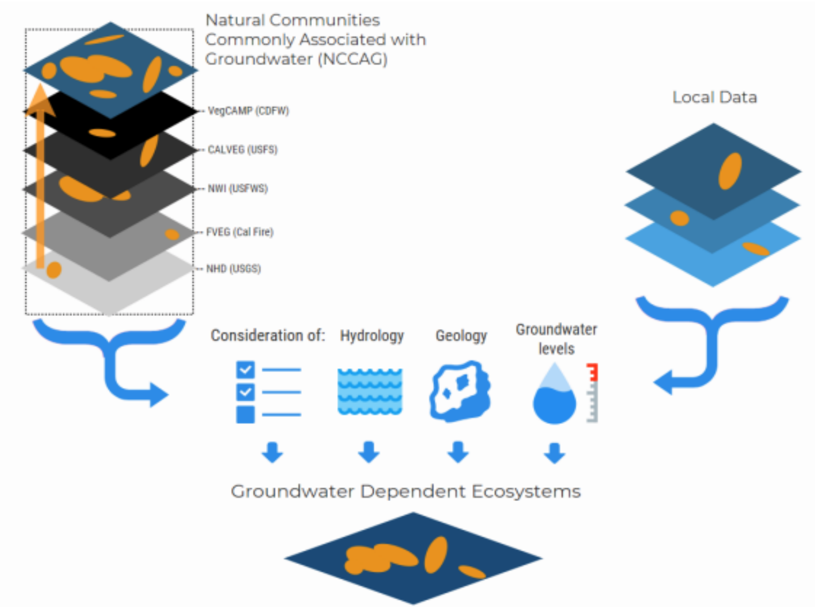


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

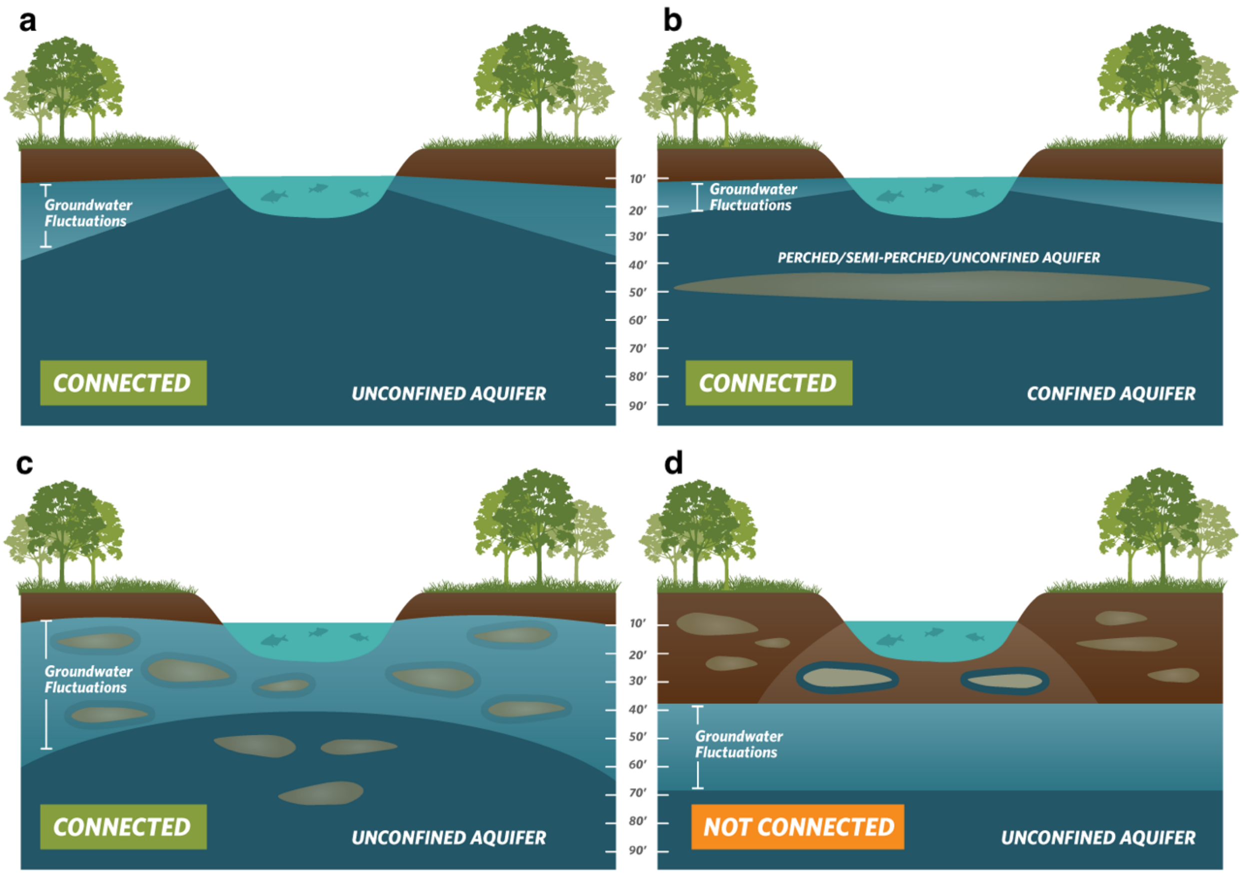

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

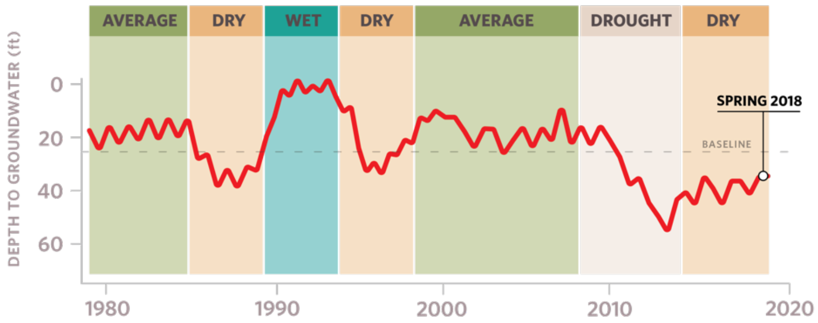

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

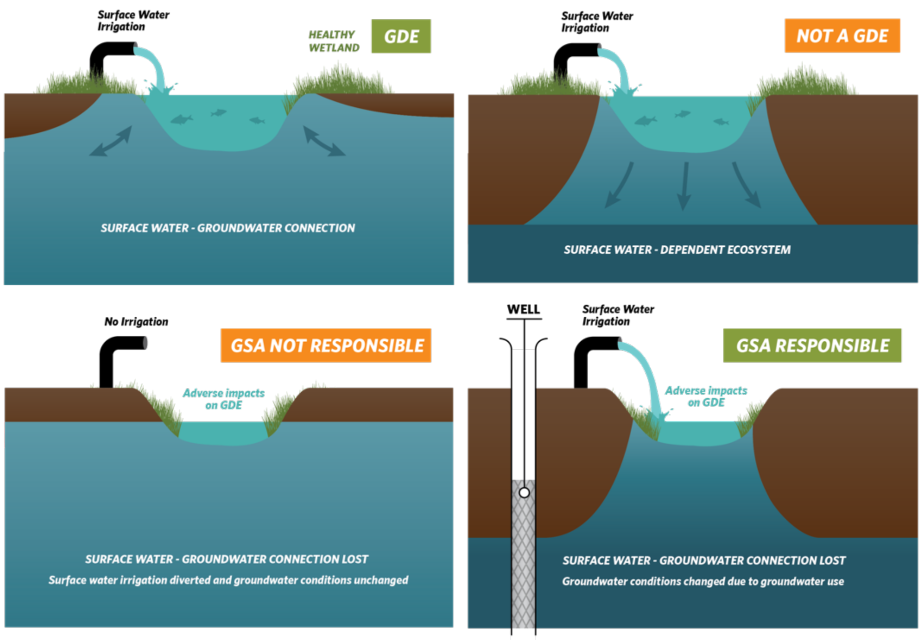

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

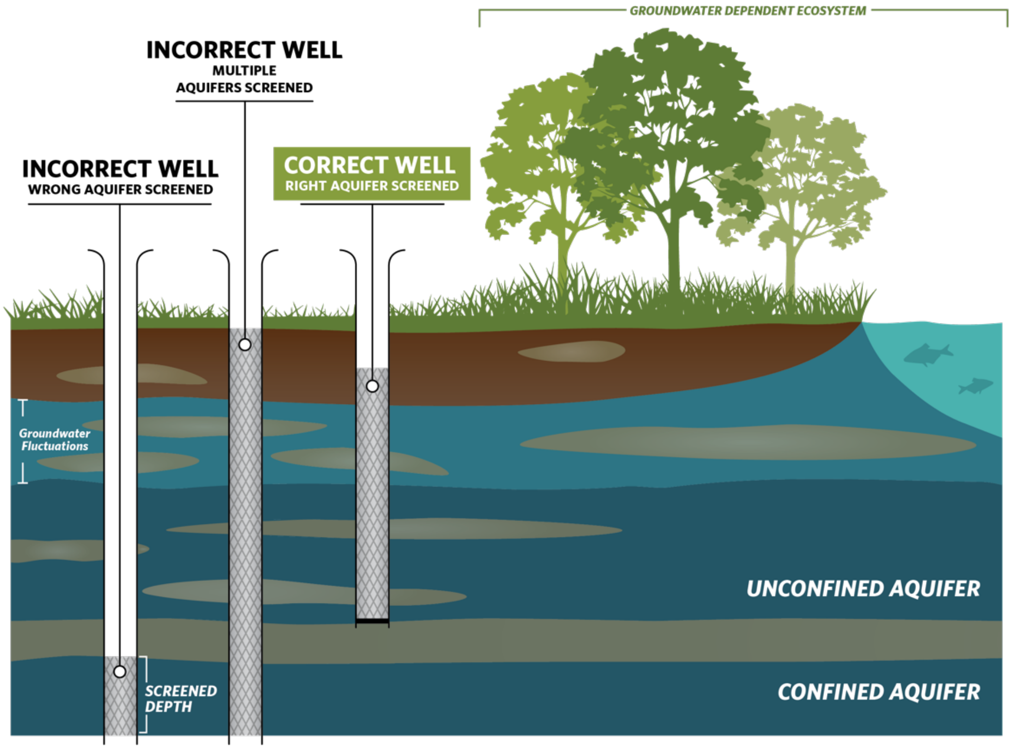

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

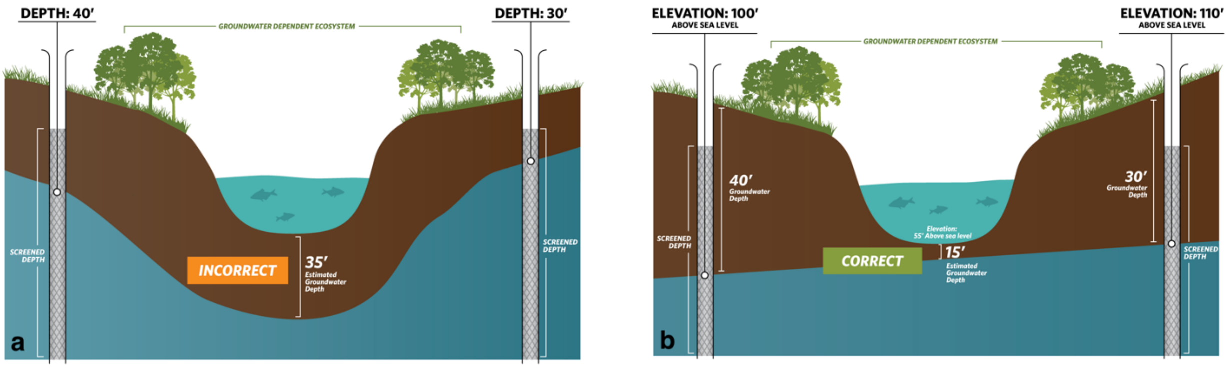

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

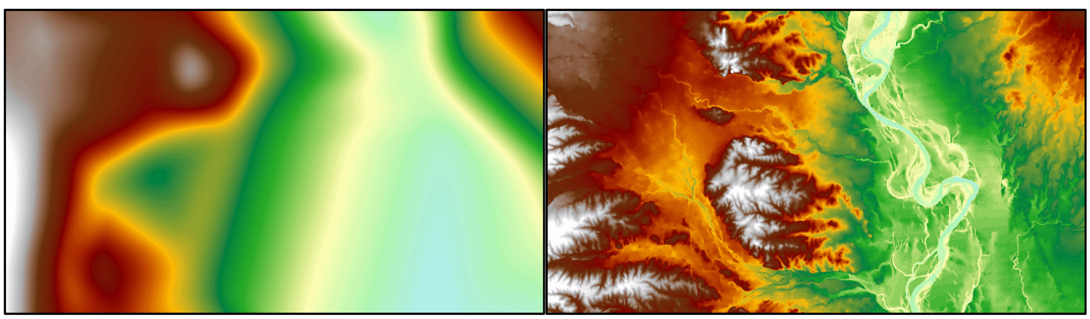

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

December 7, 2021

Napa County GSA
1195 Third Street, 2nd Floor
Napa, CA 94559

Submitted via email: Jamison.Crosby@countyofnapa.org

Re: Public Comment Letter for Napa Valley Subbasin Draft GSP

Dear Jamison Crosby,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Napa Valley Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.

2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Napa Valley Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Napa Valley Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. We note the following deficiencies with the identification of these key beneficial users.

- The plan identifies the Yocha Dehe Wintun Nation as a stakeholder within the subbasin, but does not provide a map of the tribal lands or tribal interests in the subbasin.
- The GSP identifies DACs within the subbasin and maps their locations (Figure 3-13). However, the GSP fails to clearly state the population of each DAC or include the population dependent on groundwater as their source of drinking water in the subbasin.
- The GSP provides a density map of domestic wells in the subbasin (Figure 2-4). However, the plan fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range). This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the subbasin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide the population of each identified DAC. Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). • Provide a map of tribal lands and further describe tribal interests in the subbasin.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

- Include a map showing domestic well locations and average well depth across the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **insufficient**, due to lack of a comprehensive map of ISWs in the subbasin and incomplete conclusions about the connected nature of reaches in the subbasin. Despite comprehensive discussion of stream reaches in the subbasin, no overall map is presented to illustrate the conclusions of the ISW analysis.

The GSP discusses stream delineation categorization (perennial, intermittent, tidal) as determined by the USGS and Napa County Resource Conservation District (NCRCD) datasets. The GSP also compares spring groundwater elevations over the period 2010-2019 to Napa River thalweg elevations, and discusses five monitoring sites in the subbasin that monitor stream stage concurrently with shallow and deep groundwater levels in the alluvial aquifer. The ISW section of the GSP could be improved with the following recommendations.

RECOMMENDATIONS

- Provide a map showing all the stream reaches in the subbasin, with reaches clearly labeled as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.

- Overlay the subbasin's stream reaches on depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis.

- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **incomplete**. The GSP mapped GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources, including the University of California, Davis 2019 Napa County vegetation dataset and the San Francisco Estuary Institute (SFEI) California Aquatic Resource Inventory (CARI) dataset. GDEs were identified in areas overlying groundwater within 30 feet of land surface based on spring of 2010, 2015, and 2019 groundwater depths.

We commend the GSA for the comprehensive and detailed description of GDEs, critical habitat, and species of special concern specific to each GDE subarea in the subbasin. The GSP could be improved by confirming that depth-to-groundwater measurements under GDEs are corrected for land surface elevations. We also recommend that data gaps in the GDE mapping and monitoring network are more fully described in the GSP.

RECOMMENDATIONS
● For the depth-to-groundwater contour maps (Figures 6-121 to 6-123), note the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape. ● Discuss data gaps for GDEs. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of native vegetation into the water budget is **insufficient**. The GSP text discusses evapotranspiration from native vegetation as a separate water use sector, but native vegetation appears to be grouped into a category with all evapotranspiration in the water budget tables. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the subbasin.

RECOMMENDATIONS
● Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation. ● State whether or not there are managed wetlands in the subbasin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Stakeholder Communication and Engagement Plan (Section 1.2.1).[4]

The GSP documents targeted outreach to environmental users, and notes that the interests of environmental users are represented on the GSP Advisory Committee by members of the Sierra Club, Water Audit California, and the Napa County Resource Conservation District. However, we note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement in very general terms for listed stakeholders. Public notice activities include informing stakeholders through an interested parties list, updates to the County website, and informational public meetings. Further information on outreach activities was pending an update to the Communications and Engagement Plan (Section 1.2.1.1). The GSP does not state whether tribal stakeholders are represented on the GSP Advisory Committee.

- The GSP states (p. 3- 55): *"No applications from individuals identifying as representing a DAC were received to participate on the GSPAC."* The potential for having DACs interests on the advisory committee is a step towards collaboration, but it is unclear from this statement whether there were active efforts on behalf of the GSP to engage DAC community members, notify community groups of the availability of the position, invite DAC members to apply, or nominate them to serve.

- The plan does not include documentation on how stakeholder input from the above-mentioned outreach and engagement was solicited, considered, and incorporated into the GSP development process.

- The GSP describes plans for outreach to all identified stakeholders to continue during the implementation phase of the GSP. However, the GSP does not include a detailed plan for continual opportunities for engagement through the implementation phase of the GSP that is specifically directed to DACs, domestic well owners, tribes, and environmental stakeholders within the subbasin. The plan should also clarify on whether the GSP Advisory Committee will continue to meet and inform the GSP implementation for the subbasin after the GSP is adopted by the GSA.

RECOMMENDATIONS

- In the Stakeholder Communication and Engagement Plan, describe active and targeted outreach to engage all stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Provide documentation on how stakeholder input was incorporated into the GSP development process.

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- Clarify whether the GSP Advisory Committee will continue to meet and inform the GSP implementation process for the subbasin after the GSP is adopted by the GSA.
- Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the subbasin.[5]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP establishes minimum thresholds as follows (p. 9-14): *"The MT for chronic lowering of groundwater levels is defined as the minimum static groundwater elevation observed historically in October at wells with more than 10 years of available data prior to 2015 or the inferred minimum static groundwater elevation between 2005 to 2014 (10 years prior to SGMA adoption), for wells that lack at least 10 years of observed data."* The GSP conducted a domestic well vulnerability assessment to analyze the impacts of future predicted groundwater levels on domestic wells in the subbasin. Domestic well vulnerability to potential future groundwater level declines was evaluated by comparing projected groundwater levels simulated by the Napa Valley Integrated Hydrologic Model (NVIHM) under 3 different 50-year scenarios at 31representative monitoring sites in the subbasin. The analysis determined that up to seven domestic wells in the 5th percentile pump depth group under a 40-foot offset experience some degree of vulnerability to lowered groundwater levels during dry years. The GSP does not make clear, however, the relationship between the minimum thresholds and the groundwater elevations predicted by the simulation model. Therefore, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users, especially given the absence of a domestic well mitigation plan in the GSP. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, nor does it describe how the groundwater level minimum thresholds are consistent with Human Right to Water policy and will avoid significant and unreasonable impacts on these beneficial users.[9]

The GSP established undesirable results as follows (p. 9-12): *"An Undesirable Result because of chronic lowering of groundwater levels occurs if 20% of designated Representative Monitoring*

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[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

Site (RMS) well levels fall below the MT in fall (October) for three consecutive years of fall measurements in non-drought years." Using this definition of undesirable results for groundwater levels, significant and unreasonable impacts to beneficial users experienced during dry years or periods of drought will not result in an undesirable result. This is problematic since the GSP is failing to manage the subbasin in such a way that strives to minimize significant adverse impacts to beneficial users, which are often felt greatest in below-average, dry, and drought years. Furthermore, the requirement that 20% of monitoring wells exceed the minimum threshold before triggering an undesirable result means that areas with high concentrations of domestic wells may experience impacts significantly greater than the established minimum threshold because the 20% threshold isn't triggered.

For degraded water quality, the GSP establishes minimum thresholds as follows (p. 9-59): *"The MTs for degraded water quality are defined as the state drinking water standards for total dissolved solids (TDS) (500 mg/L), nitrate as nitrogen (10 mg/L), and arsenic (10 ug/L), established at designated RMS."* Section 6.3.3 (Groundwater Quality Conditions) discusses other constituents of concern (COCs), both naturally occurring and those associated with industrial activities, that have exceeded regulatory standards. The GSP does not provide justification for the decision to set SMC for the limited set of three COCs. All COCs in the subbasin that may be impacted or exacerbated by groundwater use and/or management should be included in the SMC, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels. Include information on the impacts during prolonged periods of below average water years.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users, DACs, and tribes within the subbasin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be fully or partially de-watered at the minimum threshold.

- Consider minimum threshold exceedances during drought years when defining the groundwater level undesirable result across the subbasin.

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality.[10] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[11]

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[10] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[11] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.
- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

For chronic lowering of groundwater levels, the GSP presents a GDE vulnerability assessment to analyze the impacts of minimum thresholds on GDEs in the subbasin. For the assessment of GDE vulnerability, groundwater levels at eight representative monitoring sites (RMS) for chronic lowering of groundwater levels were evaluated against estimated maximum rooting depths for phreatophytes mapped within a half mile of each RMS. Results from one out of the eight RMS (location NapaCounty-238s) indicate impacts to GDEs, showing that a two-year decline in GDE vegetation condition occurred during successive dry years. The GSP notes that since this is a planned monitoring site, the evaluation of impacts on GDEs from groundwater elevation relies on elevations simulated by the NVIHM. We recommend that the GSP provide discussion that adaptive changes in SMC for GDEs will be made, if GDE groundwater or biological monitoring reveals that existing SMC are not protective of these ecosystems.

As stated above in our comments under Disadvantaged Communities and Drinking Water Users, the GSP established undesirable results as follows (p. 9-12): *"An Undesirable Result because of chronic lowering of groundwater levels occurs if 20% of designated Representative Monitoring Site (RMS) well levels fall below the MT in fall (October) for three consecutive years of fall measurements in non-drought years."* Again, we recommend the definition of groundwater level undesirable results include minimum threshold exceedances during any single year, which could be a dry or drought year. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse.

For depletion of interconnected surface waters, minimum thresholds are defined using both groundwater levels and a volume of surface water depletion caused by groundwater extraction. The groundwater level minimum thresholds for ISWs are set to the same minimum thresholds for chronic lowering of groundwater elevation. The interim minimum threshold for the volume of streamflow depletion is evaluated at the Napa River at Pope Street and Napa River at Oak Knoll Avenue. These depletion volumes for the summer/early fall period are 1,400 acre-feet for the Napa River at Pope Street or 3,190 acre-feet for the Napa River at Oak Knoll Avenue. The GSP states that the minimum thresholds for depletion of ISW are under development. As these are finalized, we recommend that the GSP include analysis or discussion to describe how the SMC will affect beneficial users, and more specifically GDEs, and the impact of these minimum thresholds on GDEs in the subbasin. We also recommend that the GSP evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS
• Provide discussion that adaptive changes in SMC for GDEs will be made, if GDE groundwater or biological monitoring reveals that existing SMC are not protective of these ecosystems. • Consider minimum threshold exceedances during drought years when defining the groundwater level undesirable result across the subbasin. • When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[12] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,13]

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[14] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[15] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **incomplete**, based on omission of sea level inputs into the project water budgets. The plan does not account for sea level rise inputs in the projected water budget, despite the acknowledgement that seawater intrusion from the San Pablo Bay could potentially impact groundwater within the Napa Valley subbasin (p. 9-49). The GSP integrates climate change into other key inputs (e.g., changes in precipitation, evapotranspiration, and surface water flow) of the projected water budget. We recommend that imported water, which is currently included in the "Non-Routed Delivery" column, be included as its own line item in the water budget tables (Appendices 8B-8E) to clearly communicate and quantify the changes in this input to the different water budgets.

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[12] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[13] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[14] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[15] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

The GSP incorporates climate change into the projected water budget using the CNRM-CM5 with RCP 4.5 climate model and the HadGEM2-ES with RCP 8.5 climate model. The GSP clearly and transparently incorporates extreme scenarios in the subbasin using these two models. The sustainable yield is calculated based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of sea level inputs, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, tribes, and domestic well owners.

RECOMMENDATIONS

- Include imported water, which is currently included in the "Non-Routed Delivery" column, as its own line item in the water budget tables.
- Integrate climate change into sea level inputs for the projected water budget or further justify its exclusion given that the GSP acknowledges sea level rise will impact the basin.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around GDEs, domestic wells, and DACs in the subbasin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[16]

Figure 9-3 (Chronic Lowering of Groundwater Levels Representative Monitoring Network) shows insufficient representation of GDEs and DACs for groundwater elevation monitoring. Figure 9-14 (Degraded Water Quality Representative Monitoring Network) shows insufficient representation of DACs and drinking water users for water quality monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify monitored areas.
- Increase the number of RMSs in the shallow aquifer across the subbasin as needed to map ISWs and adequately monitor all groundwater condition indicators across the

[16] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMSs.

- Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.

- Verify the location of Well ID 2800030-001. Our mapping based on the GAMA database shows a different location than Figure 9-14 of the GSP.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, tribes, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

Section 11.4.1 describes the GSA's proposed Managed Aquifer Recharge project which includes active and passive approaches to groundwater recharge. However, the GSP fails to describe the project's explicit benefits or impacts to key beneficial users, such as the environment and DACs. The GSP also fails to include a domestic well mitigation program to avoid significant and unreasonable loss of drinking water.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSAs plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[17]

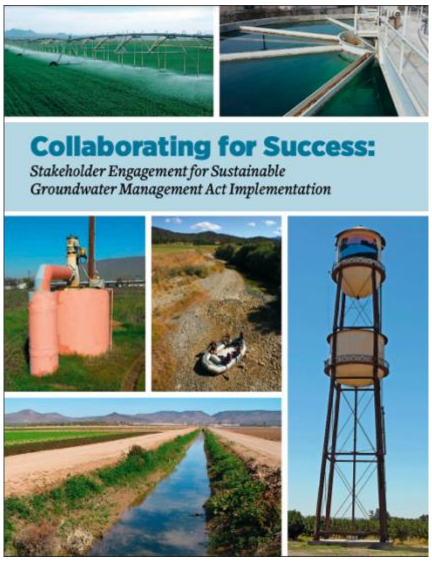
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[17] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

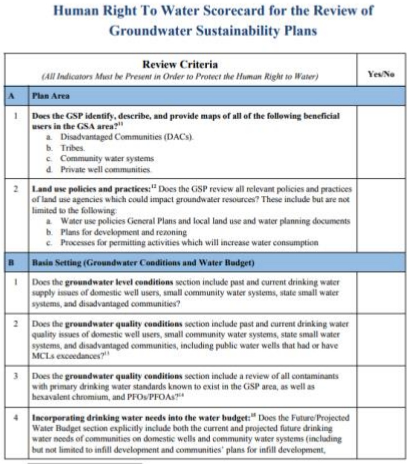
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

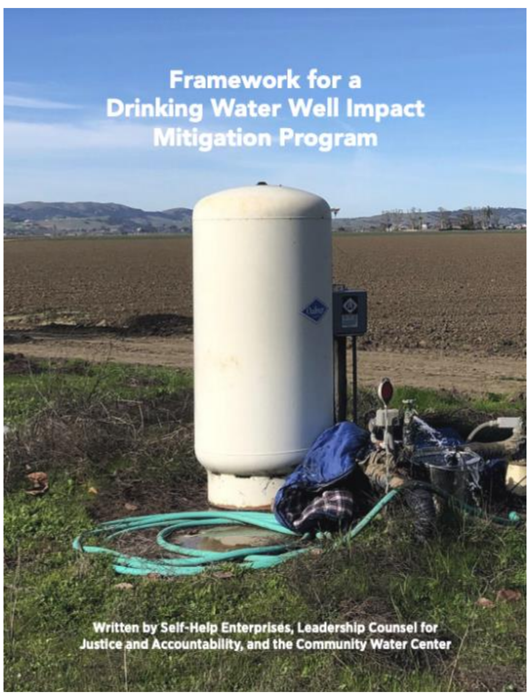
The Human Right to Water


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria (All Indicators Must be Present in Order to Protect the Human Right to Water)	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

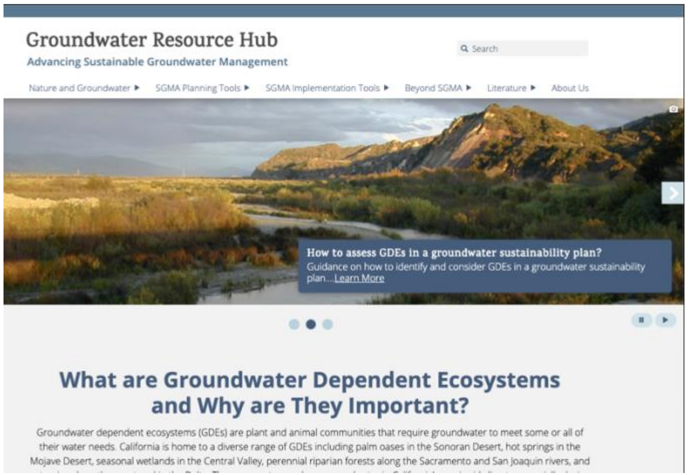
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

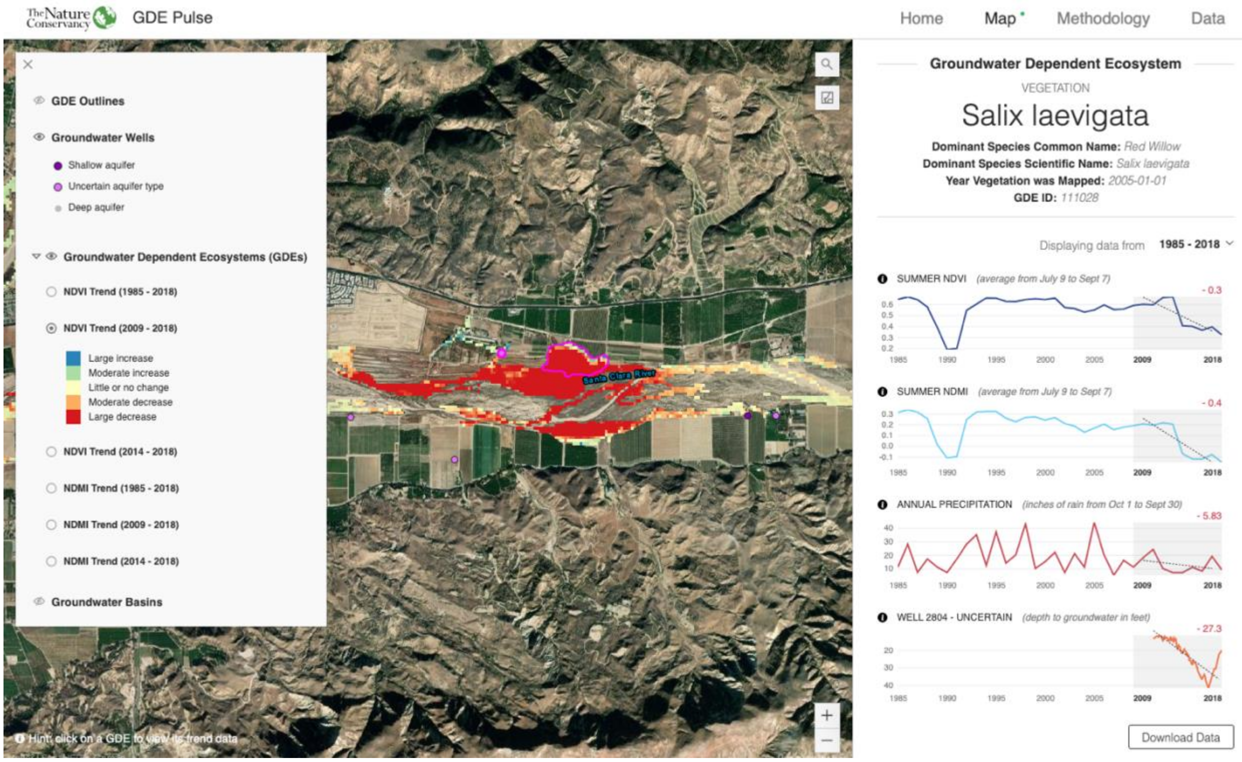
How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

---

[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

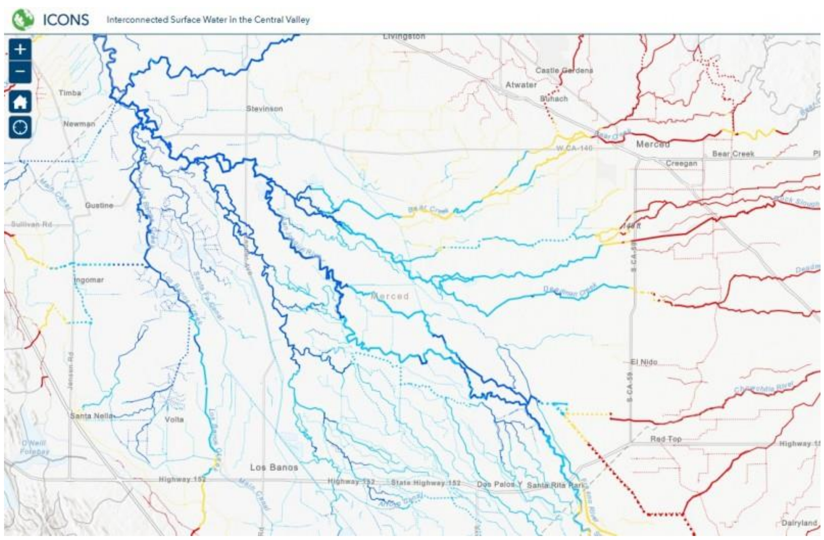
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Napa Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result “depletion of interconnected surface waters”, Attachment C provides a list of freshwater species located in the Napa Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife’s BIOS[2] as well as on The Nature Conservancy’s science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Geothlypis trichas sinuosa	Saltmarsh Common Yellowthroat	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority

Phalacrocorax auritus	Double-crested Cormorant			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
CRUSTACEANS				
Calasellus californicus	An Isopod		Special	
Syncaris pacifica	California Freshwater Shrimp	Endangered	Endangered	IUCN - Endangered
INSECTS				
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Spirinchus thaleichthys	Longfin smelt	Candidate	Threatened	Vulnerable - Moyle 2013
Oncorhynchus mykiss - CCC winter	Central California coast winter steelhead	Threatened	Special	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Dicamptodon ensatus	California Giant Salamander			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			

Pseudacris regilla	Northern Pacific Chorus Frog			
Thamnophis atratus atratus	Santa Cruz Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Anax junius	Common Green Darner			
Argia vivida	Vivid Dancer			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Enallagma praevarum	Arroyo Bluet			
Epitheca canis	Beaverpond Baskettail			
Gomphus kurilis	Pacific Clubtail			
Ischnura cervula	Pacific Forktail			
Ischnura perparva	Western Forktail			
Libellula forensis	Eight-spotted Skimmer			
Libellula saturata	Flame Skimmer			
Pachydiplax longipennis	Blue Dasher			
Pantala hymenaea	Spot-winged Glider			
Plathemis lydia	Common Whitetail			
Rhionaeschna californica	California Darner			
Rhionaeschna multicolor	Blue-eyed Darner			
Sympetrum illotum	Cardinal Meadowhawk			
Sympetrum occidentale				Not on any status lists
Sympetrum pallipes	Striped Meadowhawk			
Zoniagrion exclamationis	Exclamation Damsel			
MAMMALS				
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Juga nigrina	Black Juga			V
Gonidea angulata	Western Ridged Mussel		Special	
PLANTS				
Lasthenia conjugens	Contra Costa Goldfields	Endangered	Special	CRPR - 1B.1
Legenere limosa	False Venus'-looking-glass		Special	CRPR - 1B.1

Lilaeopsis masonii	Mason's Lilaeopsis		Special	CRPR - 1B.1
Symphyotrichum lentum	Suisun Marsh Aster		Special	CRPR - 1B.2
Arundo donax	NA			
Calochortus uniflorus	Shortstem Mariposa Lily		Special	CRPR - 4.2
Carex nudata	Torrent Sedge			
Castilleja minor spiralis	Large-flower Annual Indian-paintbrush			
Cicendia quadrangularis	Oregon Microcala			
Crassula aquatica	Water Pygmyweed			
Delphinium uliginosum	Swamp Larkspur		Special	CRPR - 4.2
Downingia concolor	NA			
Downingia pusilla	Dwarf Downingia		Special	CRPR - 2B.2
Echinodorus berteroi	Upright Burhead			
Epilobium campestre	NA			Not on any status lists
Eryngium aristulatum aristulatum	California Eryngo			
Euthamia occidentalis	Western Fragrant Goldenrod			
Helenium bigelovii	Bigelow's Sneezeweed			
Jaumea carnosa	Fleshy Jaumea			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limnanthes douglasii nivea	Douglas' Meadowfoam			
Limnanthes vinculans	Sebastopol Meadowfoam	Endangered	Endangered	CRPR - 1B.1
Limosella acaulis	Southern Mudwort			
Ludwigia peploides montevidensis	NA			Not on any status lists
Lythrum californicum	California Loosestrife			
Mimulus guttatus	Common Large Monkeyflower			
Mimulus nudatus	Bare Monkeyflower		Special	CRPR - 4.3
Mimulus tricolor	Tricolor Monkeyflower			
Myosurus minimus	NA			
Perideridia kelloggii	Kellogg's Yampah			
Perideridia oregana	Oregon Yampah			

Persicaria hydropiper	NA			Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria punctata	NA			Not on any status lists
Pleuropogon californicus californicus				Not on any status lists
Pogogyne douglasii	NA			
Psilocarphus oregonus	Oregon Woolly-heads			
Ranunculus lobbii	Lobb's Water Buttercup		Special	CRPR - 4.2
Ranunculus pusillus pusillus	Pursh's Buttercup			
Rorippa palustris palustris	Bog Yellowcress			
Salix breweri	Brewer's Willow			
Salix laevigata	Polished Willow			
Sequoia sempervirens				
Sidalcea calycosa calycosa	Annual Checker-mallow			
Stachys albens	White-stem Hedge-nettle			
Triglochin scilloides	NA			Not on any status lists
Typha domingensis	Southern Cattail			
Veronica anagallis-aquatica	NA			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

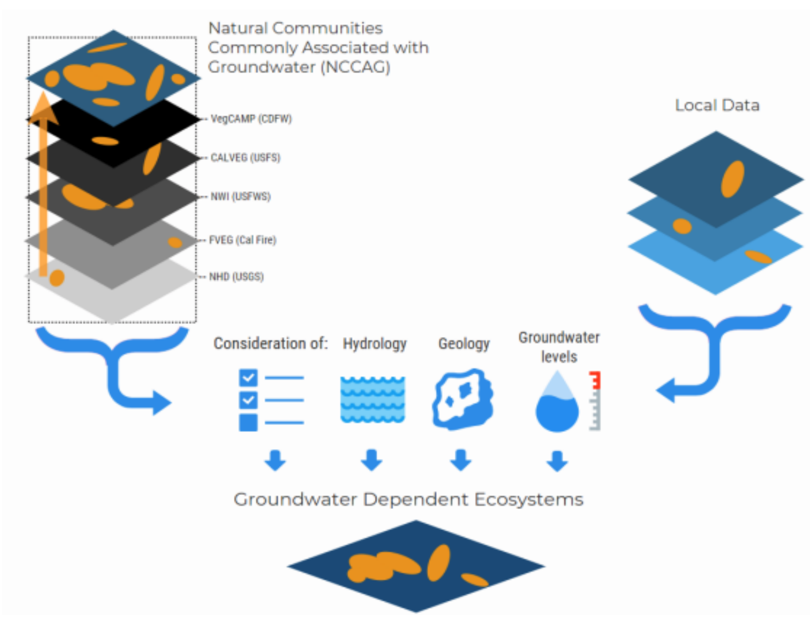


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

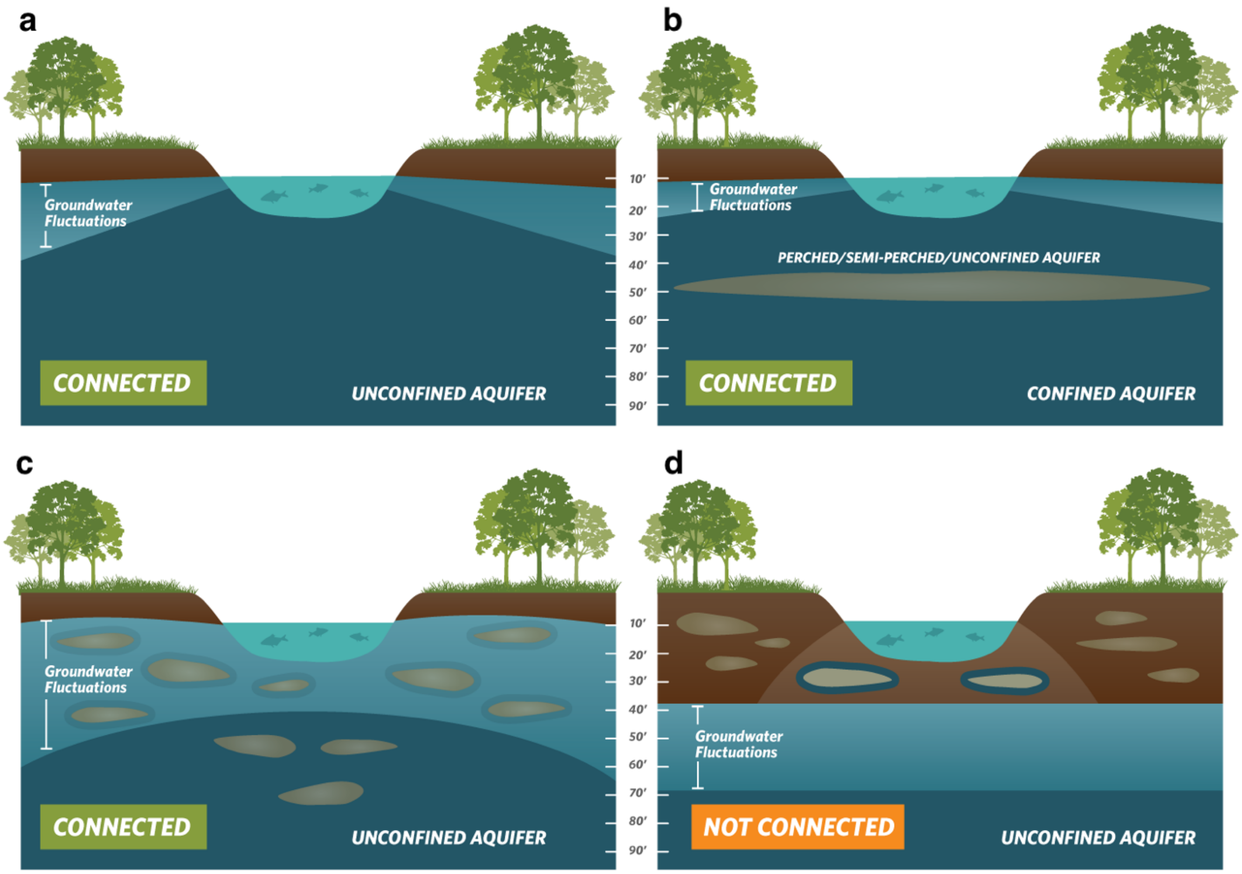

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

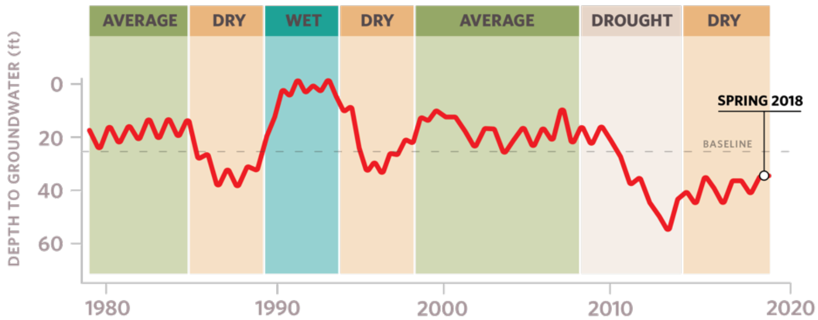

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

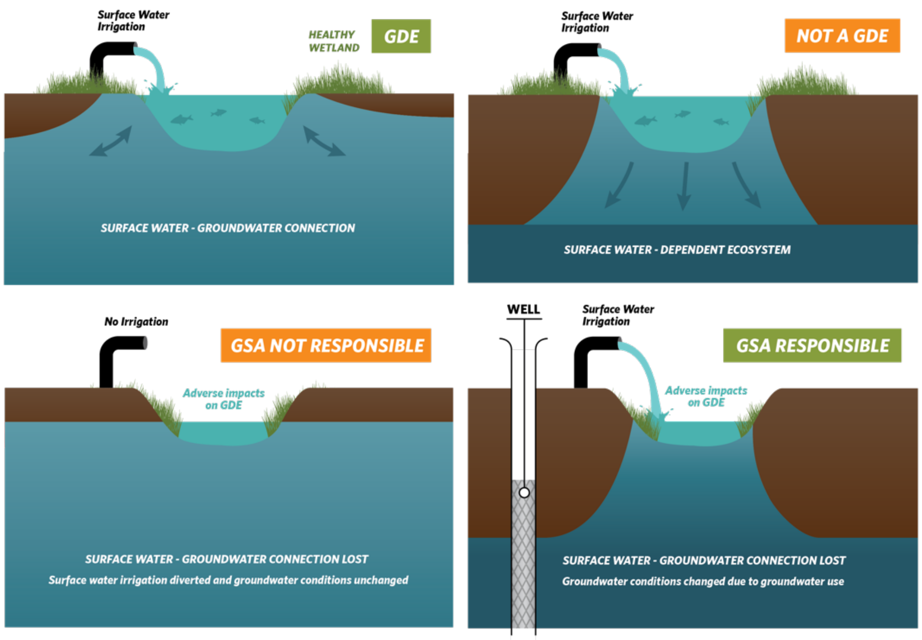

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

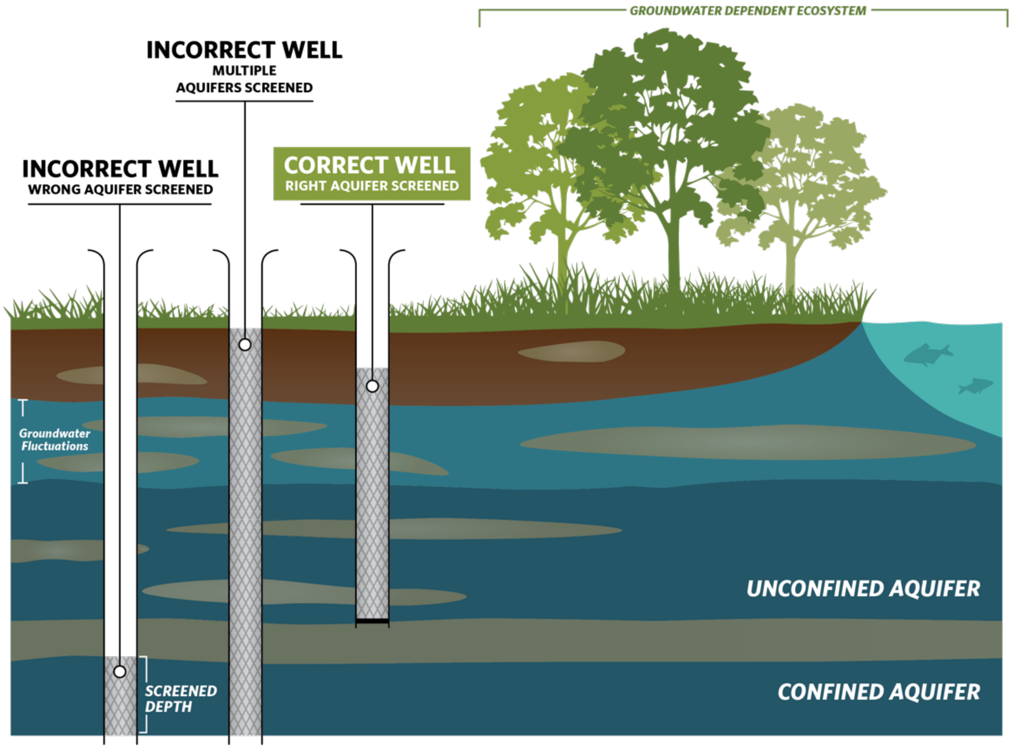

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

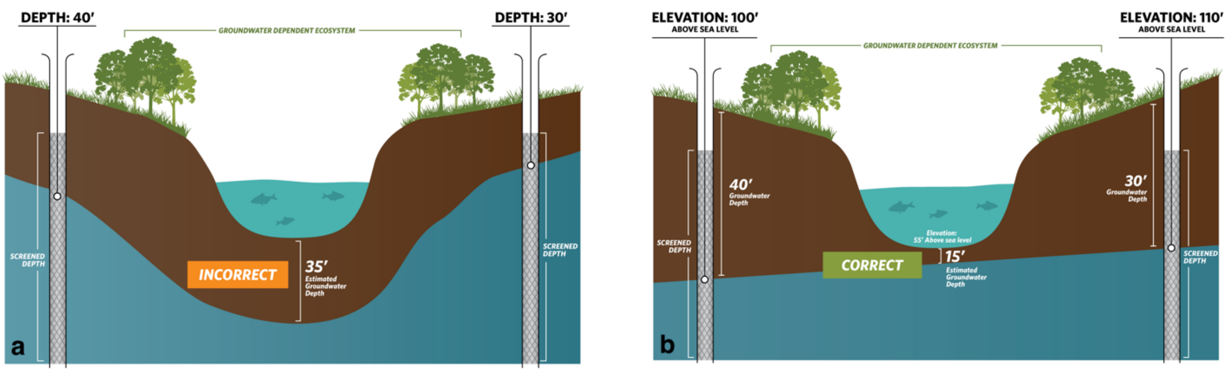

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

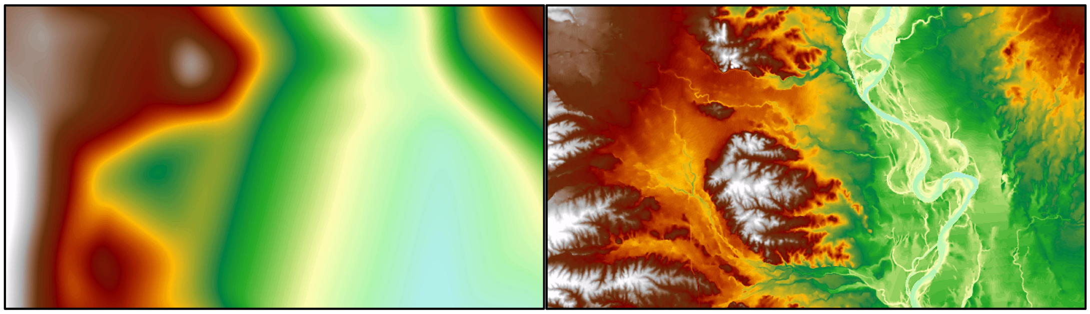

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

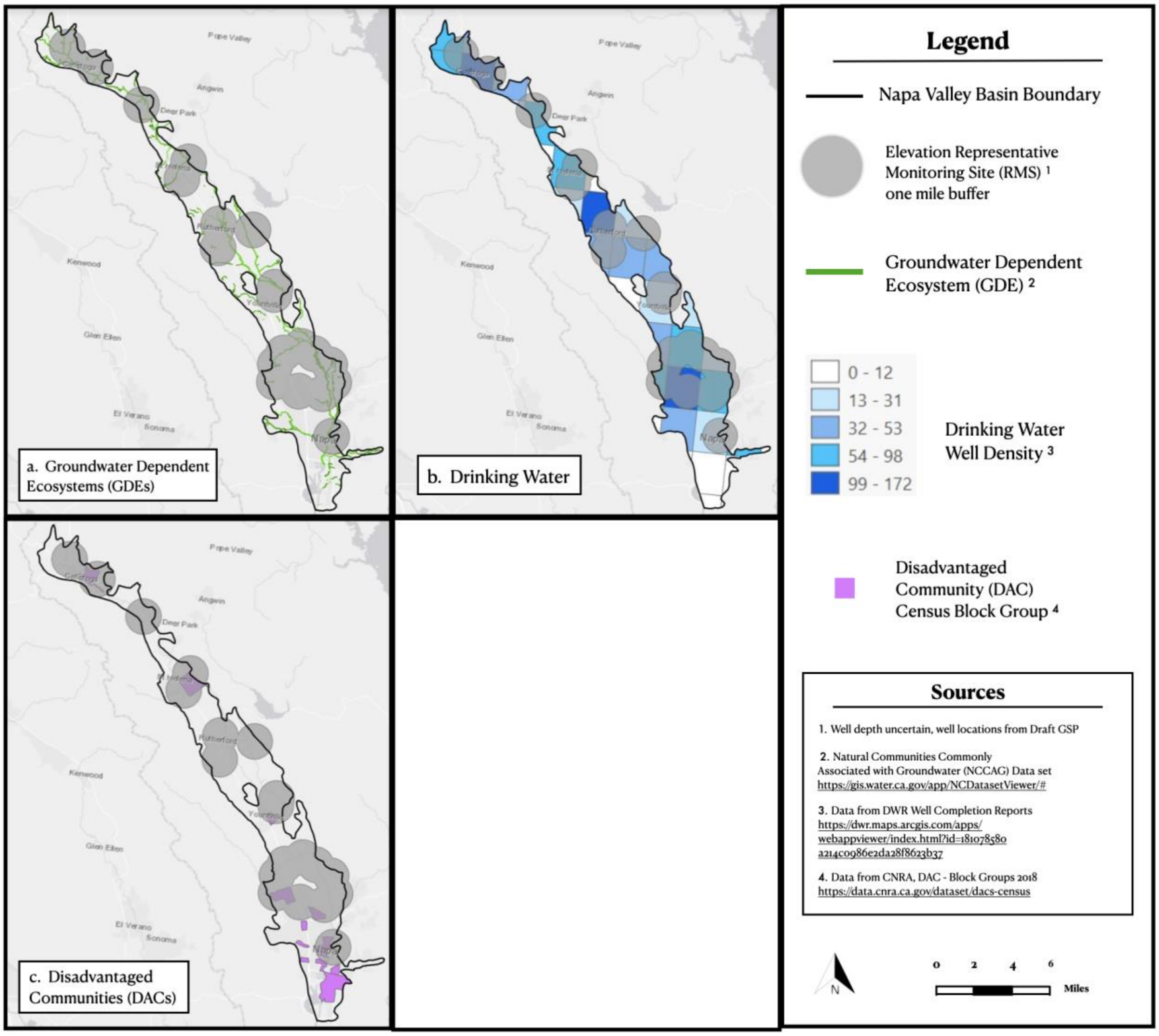

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

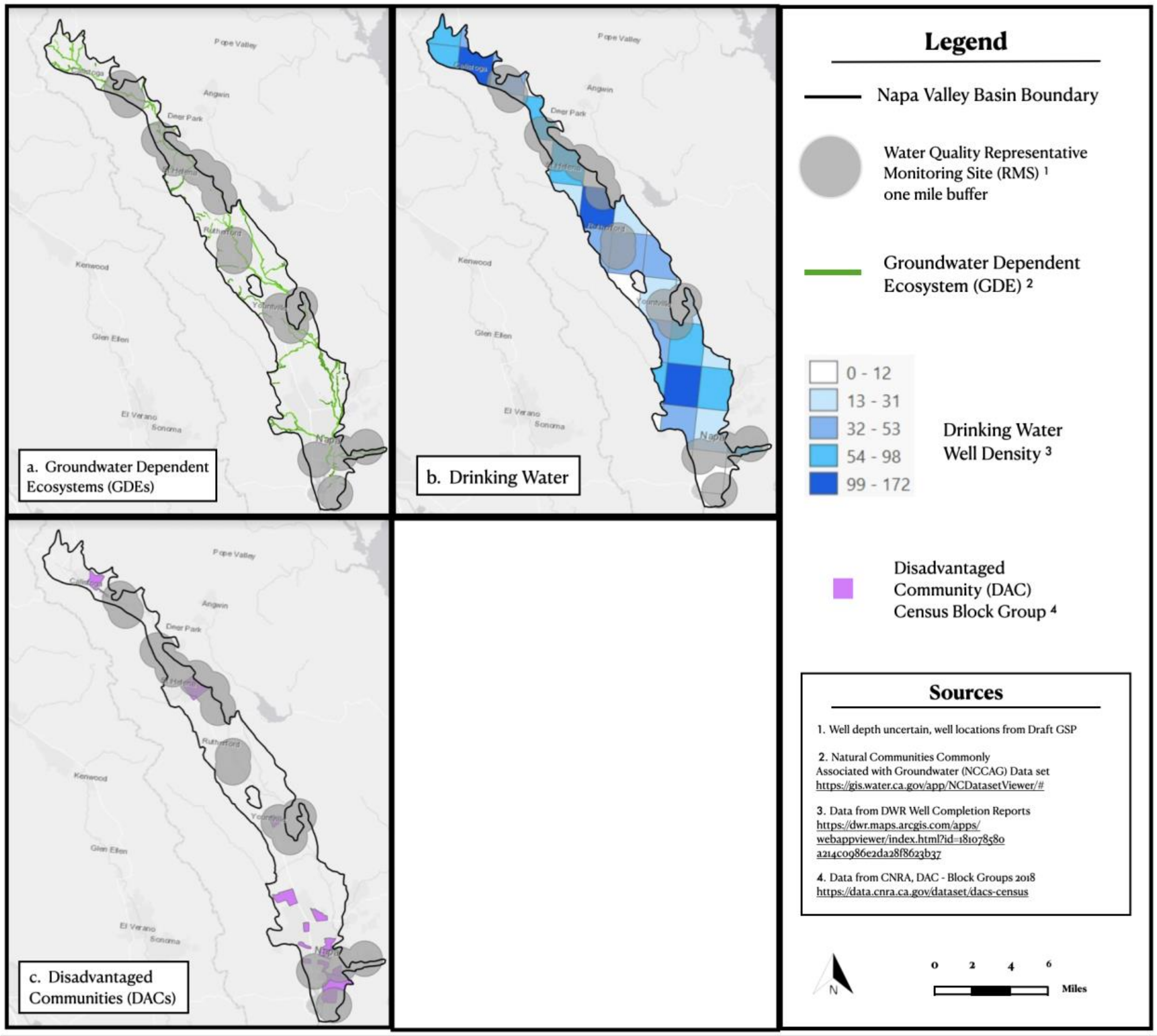

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

October 29, 2021

North American Subbasin GSAs
c/o Sacramento Groundwater Authority
5620 Birdcage Street, Suite 180
Citrus Heights, CA 95610

Submitted via web: https://portal.nasbgroundwater.org/comment/new

Re: Public Comment Letter for North American Subbasin Draft GSP

Dear Rob Swartz,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the North American Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the North American Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Amy Merrill, Ph.D.
Acting Director, California Program
American Rivers

Kristan Culbert
Associate Director, California Central Valley River Conservation
American Rivers

Attachment A

Specific Comments on the North American Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **incomplete**. The GSP provides information on DACs, including identification by name and location on a map (Figure 3-8). Figure 3-3 highlights specific water systems as they relate to DACs, and water sources for DACs are identified as local water agencies and domestic wells. Tribal lands have been identified and mapped (Figure 3-2) within the subbasin.

However, we note the following deficiencies with the identification of these key beneficial users:

- The GSP fails to describe the population of each DAC.
- While the GSP provides a map of domestic well density on Figure 3-13, it fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.

These missing elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide the population of each identified DAC. • Include a map showing domestic well locations and average well depth across the subbasin.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

- On applicable figures in Section 3, make block group map layers more transparent so that the cities and features are visible underneath, to help with understanding the communities and beneficial users that lie within each block group.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. To assess ISWs, the GSP presents depth-to-water contours from Spring 2020. The GSP states (p. 5-52): *"For purposes of this GSP the rivers and creeks were assumed to be interconnected when the depth to water is less than 30 feet bgs and are subject to future refinements."* However, using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs. Using depth-to-groundwater contours from one point in time, especially after the 2015 SGMA benchmark date, is not sufficient evidence to state that reaches are not connected to groundwater. In California's Mediterranean climate, groundwater interconnections with surface water can vary seasonally and interannually, and that natural variability needs to be taken into account when identifying ISWs.

The GSP discounts surface water supported by perched groundwater as potential ISW. The GSP states (5-53): *"Studies along the upper reaches of Racoon Creek, generally east of Highway 65, show the area is underlain by the Ione Formation and, due to its low permeability, would tend to perch water. Therefore, the surface water is not connected to the principal aquifer."* However, shallow aquifers that have the potential to support well development, support ecosystems, or provide baseflow to streams are principal aquifers, even if the majority of the subbasin's pumping is occurring in deeper principal aquifers.[2] If areas of perched groundwater are discounted as ISWs, the GSP should provide more supporting evidence of 1) vertical groundwater gradients between the perched system and deeper principal aquifers, and 2) whether perched groundwater is providing significant or economic quantities of water to streams, wells (e.g., domestic wells), and ecosystems (e.g., GDEs).

RECOMMENDATIONS

- On the map of stream reaches in the subbasin (Figure 5-31), identify gaining and losing reaches in addition to interconnected and disconnected reaches. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.

- Provide depth-to-groundwater contour maps using data from additional time periods other than just spring of 2020. Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.

- Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

[2] "'Principal aquifers' refer to aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems." [23 CCR §351(aa)]

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **incomplete**, due to use of inadequate temporal data to characterize groundwater conditions under GDEs. Appendix O (Identification of Likely Groundwater Dependent Ecosystems) presents groundwater contours from Spring 2020. The appendix states that this date was used because it has the most complete set of measurements. However, as stated above under the ISW section of this letter, use of depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) is essential to characterize groundwater conditions and the natural variability in conditions across the subbasin, and therefore should be used to determine the range of depth to groundwater around GDEs.

The GSP identified and mapped GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). Appendix O presents a complete inventory of flora and fauna, and identifies critical species in the subbasin. Appendix O states (p. 2): *"Quercus lobata (Valley Oak) was considered to have the deepest rooting depth of all species evaluated (24 feet). Therefore, with allowing for some capillary action of the soils, if depth to groundwater of less than 30 feet below ground surface groundwater was assumed to potentially being capable of supporting dependent ecosystems."* We recommend instead that a 80-foot depth-to-groundwater threshold be used when inferring whether Valley Oak polygons in the NC dataset are likely reliant on groundwater. This recommendation is based on a recent correction in TNC's rooting depth database, after finding a typo in the max rooting depth units for Valley Oak.[3] This resulted in a specific change in the max rooting depth of Valley Oak from 24 feet to 24 meters (80 feet). For all other phreatophytes, we continue to recommend that a 30-foot depth-to-groundwater threshold be used when inferring whether all other NC dataset polygons are likely reliant on groundwater.

The NC dataset is a starting point for mapping GDEs in the subbasin, and contains information on vegetation, wetlands, and hydrologic features that are commonly known to be reliant on groundwater. For practicality purposes, the conservative use of depth-to-groundwater thresholds can cost-effectively screen which NC dataset polygons are most likely reliant on groundwater (see Attachment D for more details). Because phreatophytes are foundation species within many GDEs, the depth-to-groundwater threshold is based on a phreatophyte's ability to access the water table and capillary fringe. For the majority of phreatophytes, 10 meters is considered indicative of a phreatophyte's ability to access the water table and capillary fringe due to the maximum rooting depth of most phreatophytes globally.[4,5] However, for potentially deeper rooted plants, such as Valley Oak, a deeper depth-to-groundwater threshold is required to ensure that this endemic and iconic California species is not inaccurately removed from the GSP's GDE map; until other local studies (e.g., isotopic source water analyses, rooting depth studies) prove otherwise.

RECOMMENDATIONS
• Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data

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[3] TNC. 2021. Plant Rooting Depth Database. Available at: https://groundwaterresourcehub.org/sgma-tools/gde-rooting-depths-database-for-gdes/

[4] Canadell, J. et al. 1996. Maximum rooting depth of vegetation types at the global scale. *Oecologia*, 108:583-595.

[5] Doody, T. et al. 2017. Continental mapping of groundwater dependent ecosystems: A methodological framework to integrate diverse data and expert opinion. *Journal of Hydrology: Regional Studies.* 10:61-81.

to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as valley oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used, if these species are present in the subbasin. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether Valley Oak polygons from the NC Dataset are connected to groundwater.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[6,7] The integration of these ecosystems into the water budget is **insufficient**. The water budget did explicitly include the current, historical, and projected demands of native vegetation, but did not explicitly include the current, historical, and projected demands of managed wetlands. Table 3-1 states there are over 1,700 acres of managed wetlands in the subbasin, which are mapped on Figure 3-9. The omission of explicit water demands for managed wetlands is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

RECOMMENDATION

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including managed wetlands.

B. Engaging Stakeholders

Stakeholder Engagement during GSP Development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Notice and Communications Section of the GSP (Section 11).[8]

We note the following deficiencies with the overall stakeholder engagement process:

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[6] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[7] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[8] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- The opportunities for public involvement and engagement for DACs, domestic well owners, tribes, and environmental stakeholders during the GSP development and implementation processes are described in very general terms. They include attendance at meetings, notices, direct mailers, social media, and discussions with environmental organizations for developing sustainable management criteria. Details about the nature of the engagement process for beneficial users are not provided in the Notice and Communications section (i.e. planning for public listening sessions, actions to improve accessibility and increase participation among a diversity of beneficial users).

- The GSP does not include a plan for continual opportunities for engagement through the *implementation* phase of the GSP for DACs, domestic well owners, tribes, and environmental stakeholders.

RECOMMENDATIONS
• In the Notice and Communications section, describe active and targeted outreach to engage DACs, domestic well owners, tribes, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. • Describe efforts to consult and engage with DACs and domestic well owners within the subbasin. • Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the subbasin within the GSP.[9] • Describe efforts to consult and engage with environmental stakeholders within the subbasin.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[10,11,12]

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[9] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[10] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[11] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[12] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP presents an analysis of the impact of minimum thresholds on domestic wells. Minimum thresholds were established to maintain groundwater elevations above the shallowest perforated intervals of nearby wells. The GSP states (p. 8-19): *"As documented in Appendix B, domestic well construction was analyzed to identify the top of screen intervals for existing domestic wells. By maintaining water levels above the top screen, domestic users are protected. At each RMS location, the top screen interval for domestic wells is shown in reference to the applicable MT (see Appendix Q – SMC Hydrographs). MTs could result in slightly higher energy costs associated with greater pumping lifts in limited areas. No wells are expected to go dry."*

The GSP does not however, sufficiently describe or analyze direct or indirect impacts on DACs, drinking water users or tribes when defining undesirable results, nor does it describe how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results to DACs and tribes in the subbasin.

For degraded water quality, the GSP establishes SMC for total dissolved solids (TDS) and nitrate. Minimum thresholds are set to state secondary maximum contaminant level (MCL) and the state primary MCL, respectively. SMC have not been established for other constituents of concern (COCs), however. The GSP states (8-26): *"As described in Section 5 – Groundwater Conditions, there are some areas of elevated total dissolved solids (TDS), arsenic (As), hexavalent chromium (CrVI), iron (Fe), and manganese (Mn). With no trends in As, CrVI, Fe, and Mn observed to date, the NASb is not setting SMCs for these constituents at this time."* The GSP continues (p. 8-27): *"It is also worth noting that in the Sacramento County portion of the NASb, there are well-documented larger areas of contamination and localized quality issues as described in Section 5 – Groundwater Conditions. As also described in that section, the NASb has maintained active coordination with regulators and responsible parties to address effective remediation of these contaminants. For that reason, there are no SMC for the contaminants in groundwater."* SMC should be established for all COCs in the subbasin that may be impacted and/or exacerbated by groundwater use or management, in addition to coordinating with water quality regulatory programs. Naturally occurring COCs can be exacerbated as a result of groundwater use or groundwater management within the subbasin.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[13]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs, drinking water users, and tribes.

[13] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that may be impacted or exacerbated by groundwater use and/or management. Ensure they align with drinking water standards.[14]

Groundwater Dependent Ecosystems and Interconnected Surface Waters

For chronic lowering of groundwater levels, the GSP states (p. 8-14): *"Following the calculations of the MTs, the resulting values were then compared to beneficial users to evaluate whether they would experience significant impacts at those future groundwater elevations. Hydrographs for each RMS showing actual groundwater elevations in comparison to baseline and model projected MTs are in Appendix Q – SMC Hydrographs."* Some of the hydrographs in Appendix Q show the 30 foot depth-to-water threshold used in the GDE identification. However, within the SMC section of the GSP, there is no further discussion or explanation of the impacts to GDEs, including discussion of the location of RMS wells in relation to GDEs or the impacts to GDEs when groundwater levels fall below the 30 foot threshold (or 80 feet within the context of Valley Oak).

For the depletion of interconnected surface water sustainability indicator, groundwater levels are used as a proxy. The GSP states (p. 8-42): *"Depletion of surface water is considered significant and unreasonable when the following occurs: 20% or more of the NASb interconnected surface water (ISW) representative monitoring sites (RMSs) have minimum threshold exceedances for 2 consecutive fall measurements (5 out of 23)."* The GSP continues (p. 8-43): *"The MTs for depletion of surface water are the same as for chronic lowering of groundwater, with the exception that only a subset of the RMS locations is considered interconnected with the surface water system."* However, no analysis or discussion is presented to describe how the SMC will affect GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the

[14] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

subbasin.[15] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[16]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs should include "impacts on groundwater dependent ecosystems".

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[17] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,18]

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[19] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[20] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using data from the American River Basin Study. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate extremely wet and dry scenarios into projected water budgets or select more appropriate extreme scenarios for the subbasin. The GSP assesses the effects of possible extreme conditions for a Hot-Dry (HD) scenario. Given the location of the subbasin between the American and Sacramento rivers,

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[15] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[16] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[17] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[18] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[19] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[20] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

a cool and wet scenario may also help identify potential vulnerabilities and/or opportunity areas for recharge projects. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP incorporates climate change into key inputs (e.g., precipitation and evapotranspiration) of the projected water budget. However, imported water was not quantified as part of surface water flow inputs for future water budgets. If the water budgets are incomplete, including the omission of projected climate change effects on imported water flow inputs, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, tribes, and domestic well owners.

RECOMMENDATIONS

- Incorporate climate change into imported water flow inputs for the projected water budget.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to a lack of specific plans to increase the Representative Monitoring Wells (RMWs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, tribes, GDEs, and ISWs in the subbasin.

Figure 7-8 (Representative Monitoring Wells for Chronic Lowering of Groundwater) and Figure 7-10 (Shallow Aquifer Water Quality Representative Monitoring Wells) show that no monitoring wells are located across portions of the subbasin near DACs, domestic wells, and tribes (see maps provided in Attachment E). Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[21]

The GSP provides some discussion of data gaps for GDEs and ISWs in Sections 7.4.6 (Chronic Lowering of Groundwater Levels Data Gaps), however, it does not provide specific plans, such as locations or a timeline, to fill the data gaps.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, tribes, GDEs, and ISWs to clearly identify potentially impacted areas. Increase the number of RMWs in the shallow aquifer across the subbasin as needed to adequately monitor all groundwater condition indicators. Prioritize proximity to DACs, domestic wells, tribes, and GDEs when identifying new RMWs.

[21] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

- Further describe the biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, drinking water users, and tribes. While the expansion of the Sacramento Regional Water Bank is described as a recharge project within the subbasin, the plan fails to specify any benefits the project will have to the environment or DACs. Therefore, potential project and management actions as currently proposed may overlook the protection of these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSAs plan to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For further guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[22]

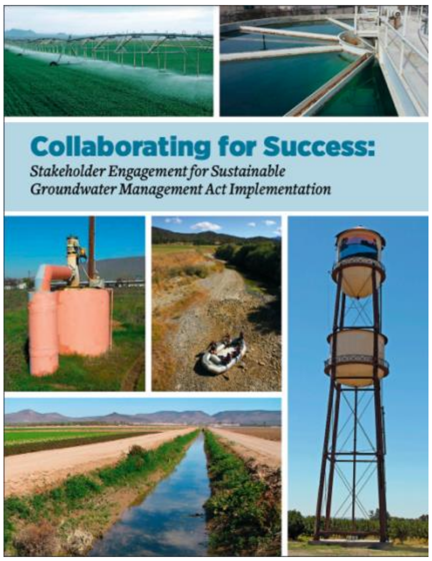
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[22] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

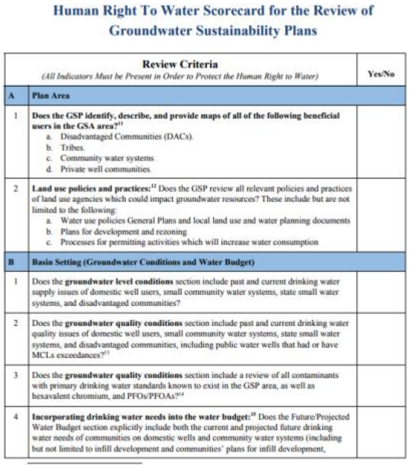
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

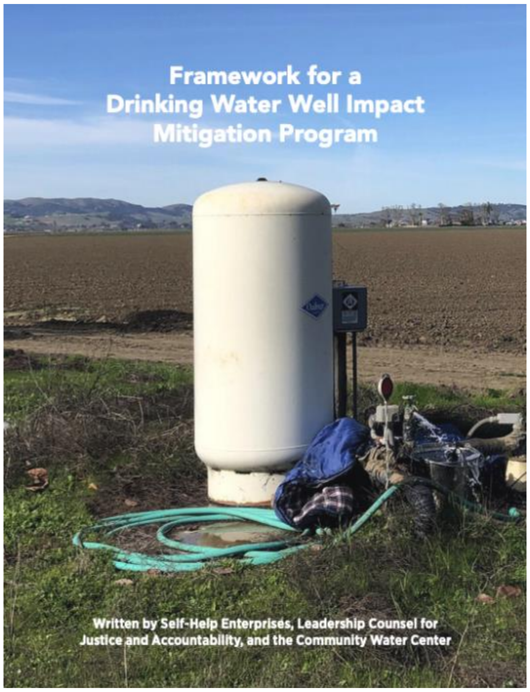


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria (All Indicators Must be Present in Order to Protect the Human Right to Water)	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

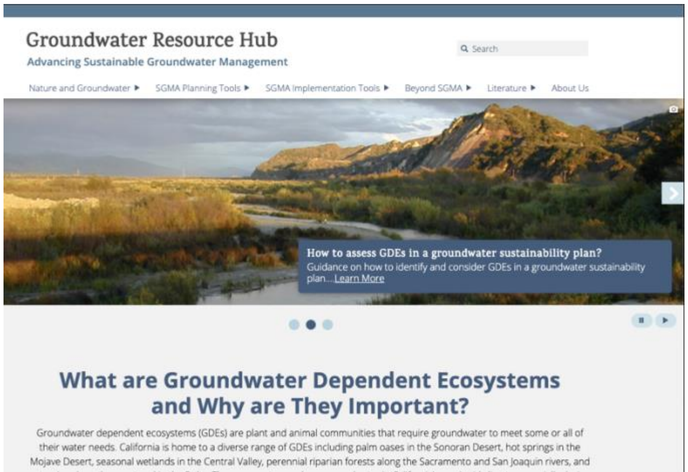
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



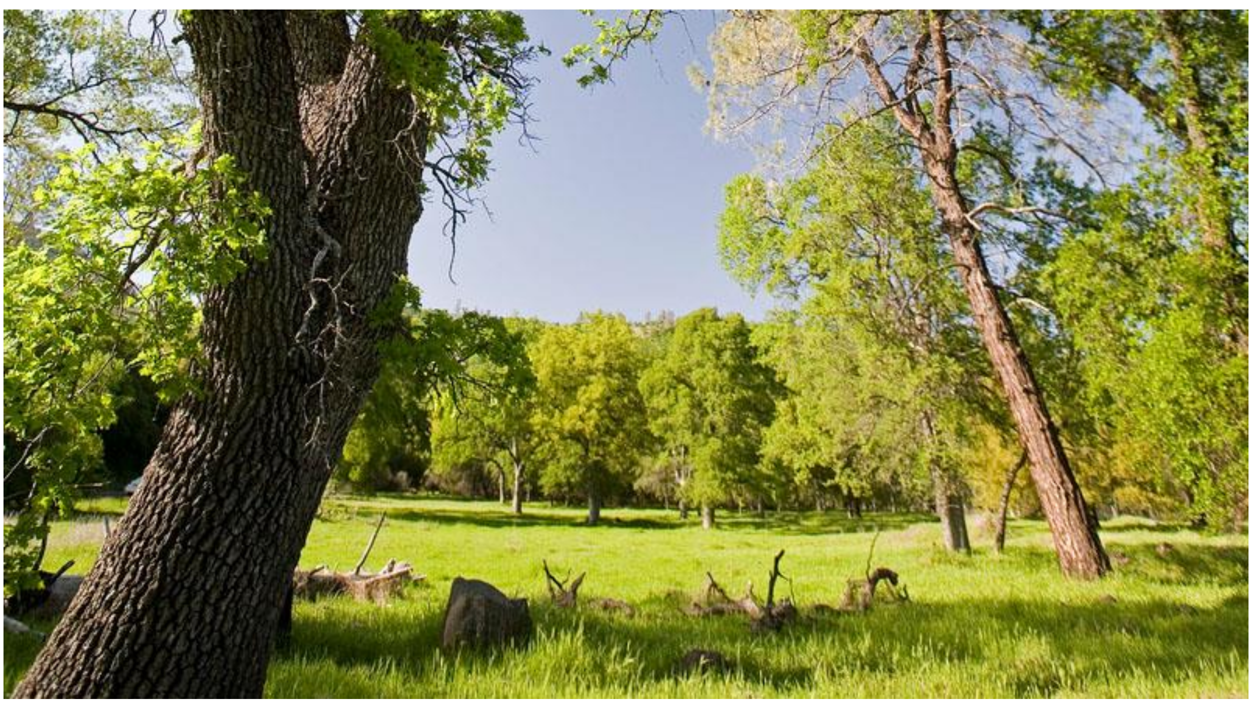
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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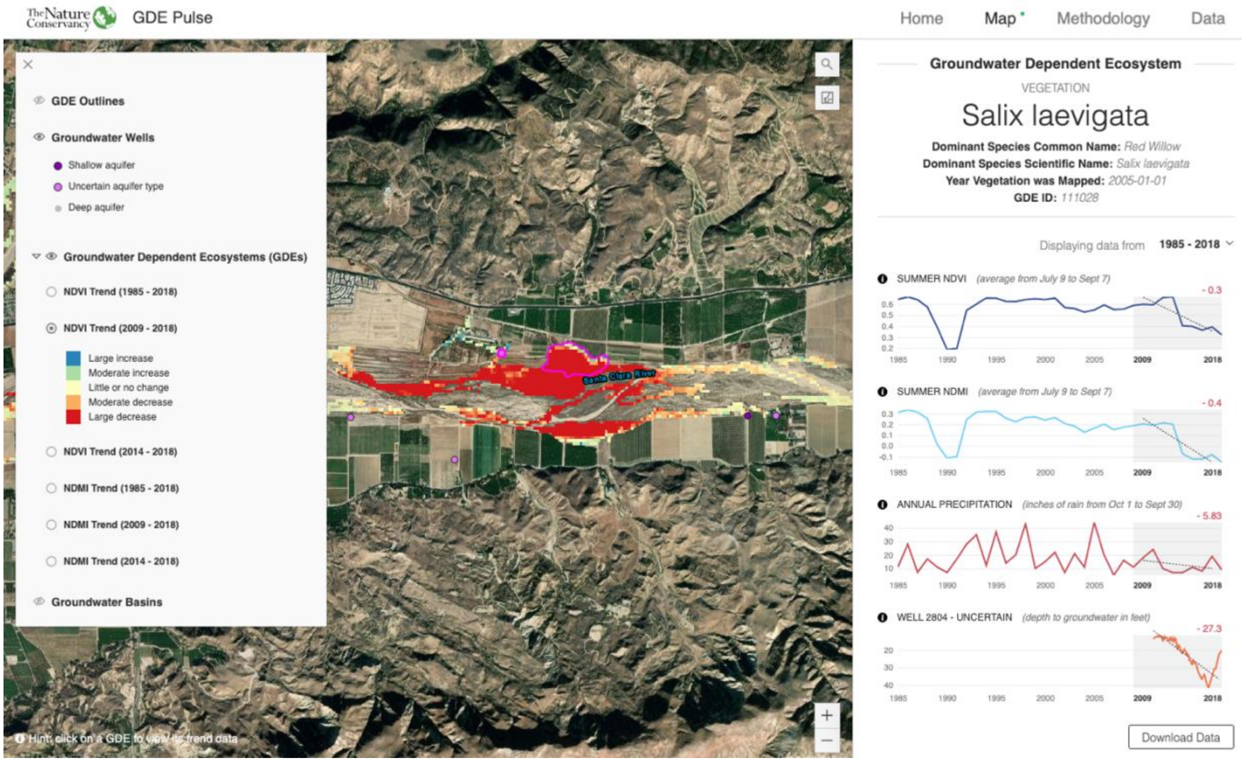
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

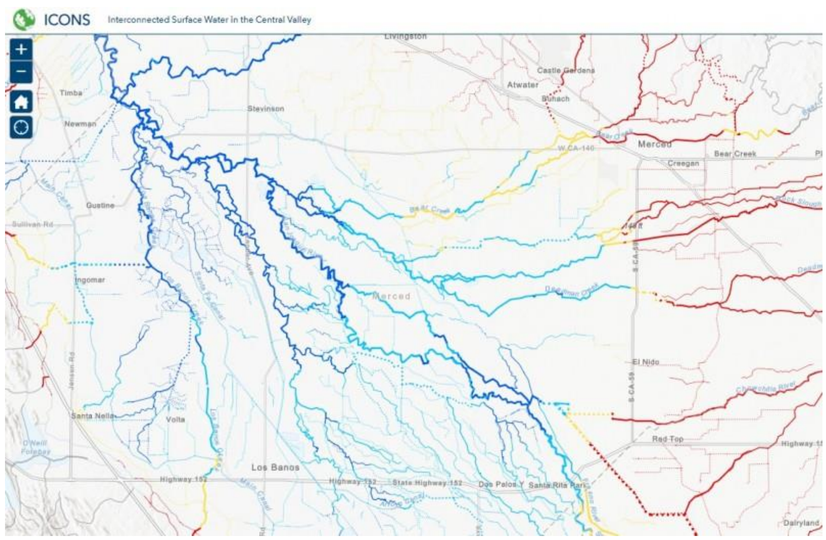
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the North American Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the North American Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Egretta thula	Snowy Egret			
Nycticorax nycticorax	Black-crowned Night-Heron			
Phalacrocorax auritus	Double-crested Cormorant			
Riparia riparia	Bank Swallow		Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Aythya affinis	Lesser Scaup			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus buccinator	Trumpeter Swan			
Cygnus columbianus	Tundra Swan			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	

Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
Branchinecta conservatio	Conservancy Fairy Shrimp	Endangered	Special	IUCN - Endangered
Cambaridae fam.	Cambaridae fam.			
Crangonyx spp.	Crangonyx spp.			
Cyprididae fam.	Cyprididae fam.			
Gammaridae fam.	Gammaridae fam.			
Gammarus spp.	Gammarus spp.			
Hyalella spp.	Hyalella spp.			
FISH				
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Pogonichthys macrolepidotus	Sacramento splittail		Special Concern	Vulnerable - Moyle 2013
Spirinchus thaleichthys	Longfin smelt	Candidate	Threatened	Vulnerable - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endangered	Endangered	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC

Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
Pseudacris regilla	Northern Pacific Chorus Frog			
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis sirtalis fitchi	Valley Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Ablabesmyia annulata				Not on any status lists
Ablabesmyia spp.	Ablabesmyia spp.			
Acentrella spp.	Acentrella spp.			
Aeshna spp.	Aeshna spp.			
Aeshnidae fam.	Aeshnidae fam.			
Agabus lutosus				Not on any status lists
Agabus spp.	Agabus spp.			
Alotanypus spp.	Alotanypus spp.			
Ambrysus spp.	Ambrysus spp.			
Anax junius	Common Green Darner			
Anax spp.	Anax spp.			
Anopheles spp.	Anopheles spp.			
Apedilum spp.	Apedilum spp.			
Argia agrioides	California Dancer			
Argia emma	Emma's Dancer			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetidae fam.	Baetidae fam.			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Belostoma spp.	Belostoma spp.			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Brillia spp.	Brillia spp.			
Caenis amica	A Mayfly			
Caenis latipennis	A Mayfly			
Caenis spp.	Caenis spp.			
Callibaetis spp.	Callibaetis spp.			
Camelobaetidius kickapoo				Not on any status lists
Camelobaetidius spp.	Camelobaetidius spp.			
Centroptilum album	A Mayfly			
Centroptilum spp.	Centroptilum spp.			

Ceraclea spp.	Ceraclea spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chimarra spp.	Chimarra spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Cladopelma spp.	Cladopelma spp.			
Cladotanytarsus marki				Not on any status lists
Cladotanytarsus spp.	Cladotanytarsus spp.			
Clinotanypus spp.	Clinotanypus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corisella decolor				Not on any status lists
Corixidae fam.	Corixidae fam.			
Cricotopus annulator				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Cryptotendipes spp.	Cryptotendipes spp.			
Culex spp.	Culex spp.			
Culicidae fam.	Culicidae fam.			
Culiseta spp.	Culiseta spp.			
Dicrotendipes adnilus				Not on any status lists
Dicrotendipes spp.	Dicrotendipes spp.			
Dubiraphia brunnescens	Brownish Dubiraphian Riffle Beetle		Special	
Dubiraphia spp.	Dubiraphia spp.			
Dytiscidae fam.	Dytiscidae fam.			
Dytiscus marginicollis				Not on any status lists
Enallagma boreale	Boreal Bluet			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Enallagma cyathigerum				Not on any status lists
Enallagma praevarum	Arroyo Bluet			
Enallagma spp.	Enallagma spp.			
Endochironomus spp.	Endochironomus spp.			
Ephydridae fam.	Ephydridae fam.			
Epitheca canis	Beaverpond Baskettail			
Erythemis collocata	Western Pondhawk			
Eukiefferiella spp.	Eukiefferiella spp.			
Euryhapsis spp.	Euryhapsis spp.			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Gerridae fam.	Gerridae fam.			
Glyptotendipes spp.	Glyptotendipes spp.			
Gomphidae fam.	Gomphidae fam.			

Gomphus kurilis	Pacific Clubtail			
Gomphus spp.	Gomphus spp.			
Helochares normatus				Not on any status lists
Helophorus spp.	Helophorus spp.			
Hetaerina americana	American Rubyspot			
Hydraena spp.	Hydraena spp.			
Hydrophilidae fam.	Hydrophilidae fam.			
Hydrophilus triangularis				Not on any status lists
Hydropsyche alternans				Not on any status lists
Hydropsyche californica	A Caddisfly			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila ajax	A Caddisfly			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ironodes spp.	Ironodes spp.			
Ischnura cervula	Pacific Forktail			
Ischnura perparva	Western Forktail			
Ischnura spp.	Ischnura spp.			
Labrundinia spp.	Labrundinia spp.			
Laccobius spp.	Laccobius spp.			
Laccophilus spp.	Laccophilus spp.			
Larsia spp.	Larsia spp.			
Lepidostoma spp.	Lepidostoma spp.			
Leptoceridae fam.	Leptoceridae fam.			
Lestes congener	Spotted Spreadwing			
Libellula forensis	Eight-spotted Skimmer			
Libellula luctuosa	Widow Skimmer			
Libellula pulchella	Twelve-spotted Skimmer			
Libellula saturata	Flame Skimmer			
Libellula spp.	Libellula spp.			
Libellulidae fam.	Libellulidae fam.			
Limnophyes spp.	Limnophyes spp.			
Liodessus obscurellus				Not on any status lists
Liodessus spp.	Liodessus spp.			
Mesovelia spp.	Mesovelia spp.			
Micrasema spp.	Micrasema spp.			
Microchironomus nigrovittatus				Not on any status lists
Microchironomus spp.	Microchironomus spp.			
Micropsectra spp.	Micropsectra spp.			
Microtendipes spp.	Microtendipes spp.			
Microvelia spp.	Microvelia spp.			

Mideopsis pumila				Not on any status lists
Mideopsis spp.	Mideopsis spp.			
Mystacides alafimbriatus	A Caddisfly			
Mystacides spp.	Mystacides spp.			
Nanocladius spp.	Nanocladius spp.			
Nectopsyche dorsalis	A Caddisfly			
Nectopsyche gracilis	A Caddisfly			
Nectopsyche spp.	Nectopsyche spp.			
Ochthebius spp.	Ochthebius spp.			
Ophiogomphus arizonicus				Not on any status lists
Ophiogomphus occidentis	Sinuous Snaketail			
Ophiogomphus spp.	Ophiogomphus spp.			
Ordobrevia nubifera				Not on any status lists
Orthocladius spp.	Orthocladius spp.			
Oxyethira spp.	Oxyethira spp.			
Pachydiplax longipennis	Blue Dasher			
Pantala hymenaea	Spot-winged Glider			
Parachaetocladius spp.	Parachaetocladius spp.			
Parachironomus spp.	Parachironomus spp.			
Paracloeodes minutus	A Small Minnow Mayfly			
Parakiefferiella spp.	Parakiefferiella spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Paratendipes spp.	Paratendipes spp.			
Peltodytes spp.	Peltodytes spp.			
Pentaneura inconspicua				Not on any status lists
Pentaneura spp.	Pentaneura spp.			
Perlodidae fam.	Perlodidae fam.			
Petrophila confusalis				Not on any status lists
Petrophila spp.	Petrophila spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Plathemis lydia	Common Whitetail			
Polypedilum albicorne				Not on any status lists
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Progomphus borealis	Gray Sanddragon			
Protoptila spp.	Protoptila spp.			
Psectrocladius spp.	Psectrocladius spp.			
Psectrotanypus spp.	Psectrotanypus spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Pseudosmittia spp.	Pseudosmittia spp.			

Psychodidae fam.	Psychodidae fam.			
Rhagovelia spp.	Rhagovelia spp.			
Rheotanytarsus hamatus				Not on any status lists
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna californica	California Darner			
Rhionaeschna multicolor	Blue-eyed Darner			
Robackia demeijeri				Not on any status lists
Simuliidae fam.	Simuliidae fam.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sperchon stellata				Not on any status lists
Stenochironomus spp.	Stenochironomus spp.			
Stylurus olivaceus	Olive Clubtail			
Sympetrum corruptum	Variegated Meadowhawk			
Tanypus spp.	Tanypus spp.			
Tanytarsus angulatus				Not on any status lists
Tanytarsus spp.	Tanytarsus spp.			
Tipulidae fam.	Tipulidae fam.			
Tramea lacerata	Black Saddlebags			
Tramea spp.	Tramea spp.			
Trichocorixa calva				Not on any status lists
Trichocorixa spp.	Trichocorixa spp.			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus spp.	Tropisternus spp.			
Unionicolidae fam.	Unionicolidae fam.			
Uvarus subtilis				Not on any status lists
Wormaldia spp.	Wormaldia spp.			
Xenochironomus spp.	Xenochironomus spp.			
Zavrelimyia spp.	Zavrelimyia spp.			
Zoniagrion exclamationis	Exclamation Damsel			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Ferrissia spp.	Ferrissia spp.			
Galba spp.	Galba spp.			

Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus circumstriatus	Disc Gyro			CS
Gyraulus crista	Star Gyro			CS
Gyraulus spp.	Gyraulus spp.			
Helisoma spp.	Helisoma spp.			
Hydrobiidae fam.	Hydrobiidae fam.			
Lymnaea spp.	Lymnaea spp.			
Lymnaeidae fam.	Lymnaeidae fam.			
Margaritifera falcata	Western Pearlshell		Special	
Menetus opercularis	Button Sprite			CS
Menetus spp.	Menetus spp.			
Physa acuta	Pewter Physa			Not on any status lists
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Planorbidae fam.	Planorbidae fam.			
Sphaeriidae fam.	Sphaeriidae fam.			
Sphaerium spp.	Sphaerium spp.			
Anodonta californiensis	California Floater		Special	
PLANTS				
Chloropyron molle hispidum			Special	CRPR - 1B.1
Downingia pusilla	Dwarf Downingia		Special	CRPR - 2B.2
Gratiola heterosepala	Boggs Lake Hedge-hyssop		Endangered	CRPR - 1B.2
Legenere limosa	False Venus'-looking-glass		Special	CRPR - 1B.1
Orcuttia viscida	Sacramento Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Sagittaria sanfordii	Sanford's Arrowhead		Special	CRPR - 1B.2
Alnus rhombifolia	White Alder			
Alopecurus pratensis	NA			
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Ammannia robusta	Grand Redstem			
Arundo donax	NA			
Baccharis salicina				Not on any status lists
Brodiaea nana				Not on any status lists
Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche marginata	Winged Water-starwort			
Cephalanthus occidentalis	Common Buttonbush			
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Crassula solieri	NA			Not on any status lists
Downingia bicornuta	NA			

Downingia cuspidata	Toothed Calicoflower			
Downingia ornatissima	NA			
Elatine brachysperma	Shortseed Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Elodea canadensis	Broad Waterweed			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium castrense	Great Valley Eryngo			
Eryngium vaseyi vallicola				Not on any status lists
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Gratiola ebracteata	Bractless Hedge-hyssop			
Helenium puberulum	Rosilla			
Isoetes howellii	NA			
Isoetes orcuttii	NA			
Juncus acuminatus	Sharp-fruit Rush			
Juncus diffusissimus	NA			
Juncus effusus pacificus				
Juncus uncialis	Inch-high Rush			
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lemna minor	Lesser Duckweed			
Lemna valdiviana	Pale Duckweed			
Limnanthes alba alba	White Meadowfoam			
Limnanthes floccosa californica	Shippee Meadowfoam	Endangered	Endangered	CRPR - 1B.1
Ludwigia hexapetala	NA			Not on any status lists
Ludwigia palustris	Marsh Seedbox			
Ludwigia peploides montevidensis	NA			Not on any status lists
Ludwigia peploides peploides	NA			Not on any status lists
Lycopus americanus	American Bugleweed			
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus guttatus	Common Large Monkeyflower			
Mimulus tricolor	Tricolor Monkeyflower			
Myosotis laxa	Small Forget-me-not			
Myosotis scorpioides	NA			
Myosurus apetalus	Bristly Mousetail			
Myriophyllum aquaticum	NA			

Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Navarretia myersii myersii	Pincushion Navarretia		Special	CRPR - 1B.1
Panicum dichotomiflorum	NA			
Persicaria hydropiper	NA			Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys distantiflorus	California Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys undulatus	NA			Not on any status lists
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pogogyne zizyphoroides				Not on any status lists
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Psilocarphus tenellus	NA			
Ranunculus bonariensis	NA			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rumex conglomeratus	NA			
Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Salix breweri	Brewer's Willow			
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus californicus	California Bulrush			
Sidalcea calycosa calycosa	Annual Checker-mallow			
Stachys stricta	Sonoma Hedge-nettle			

Triglochin scilloides	NA			Not on any status lists
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	NA			

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

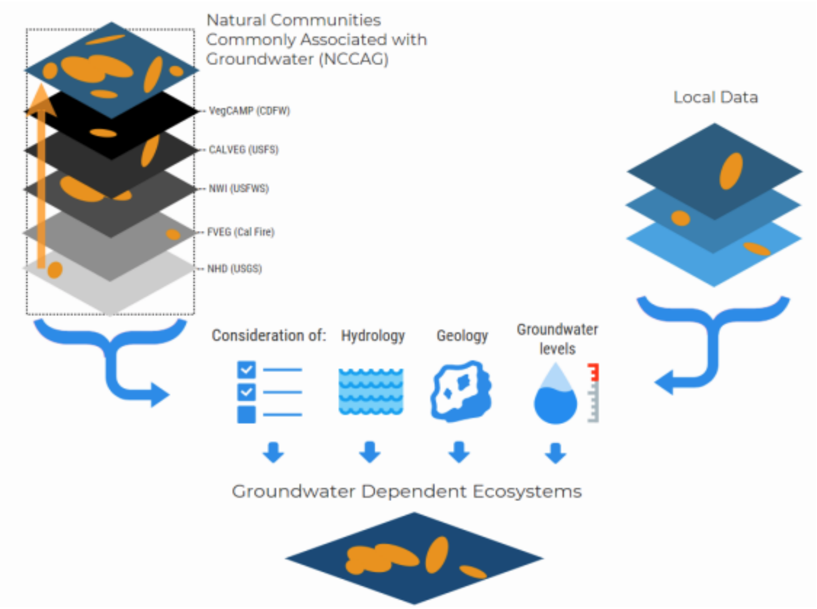


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

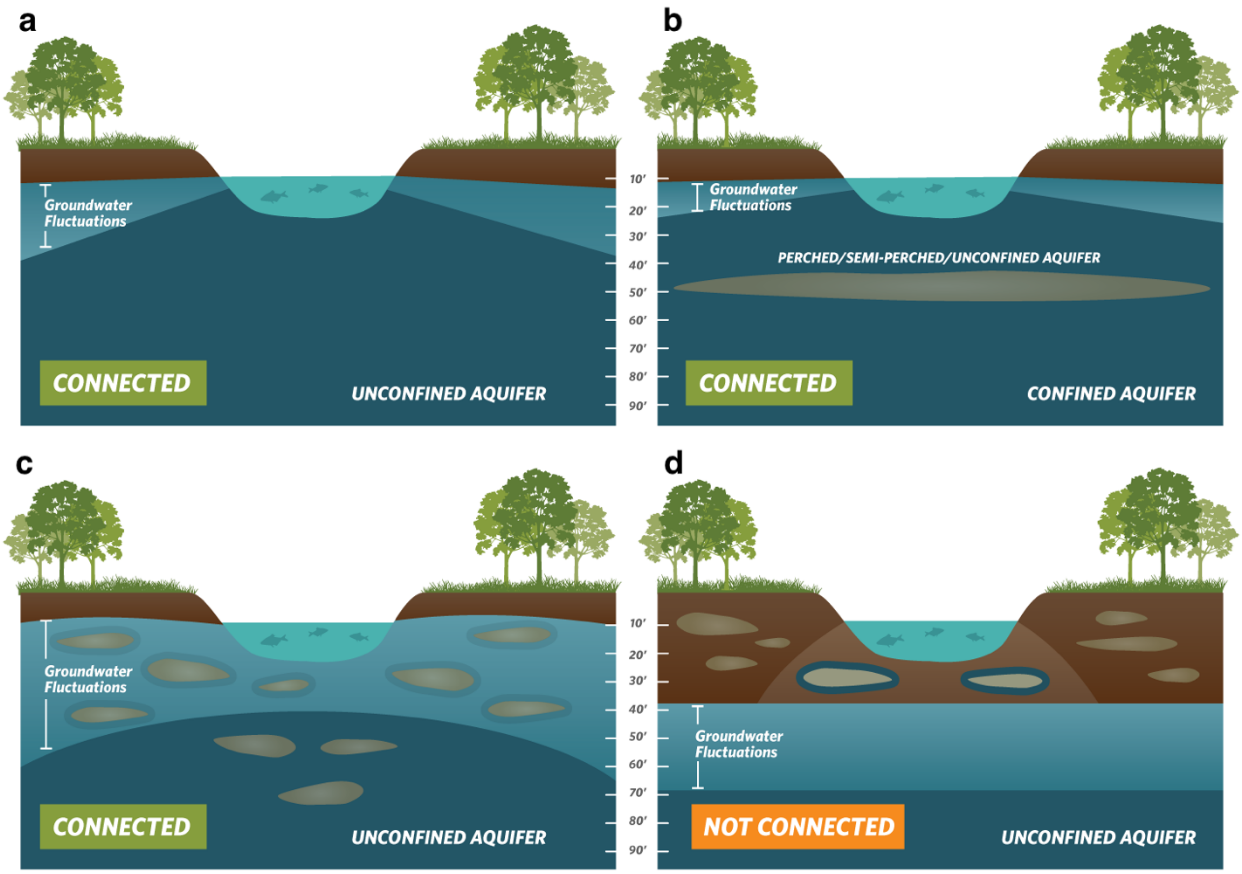

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

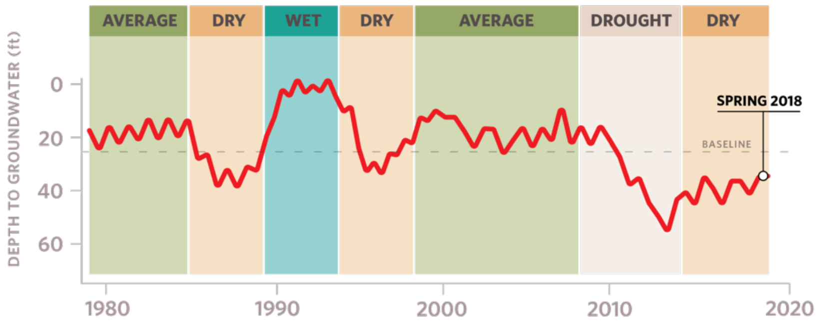

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

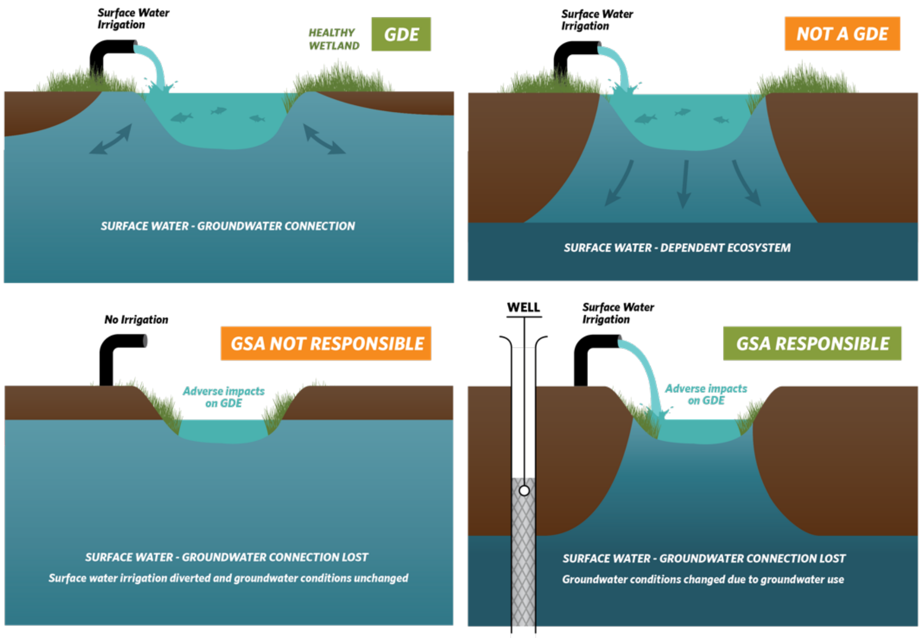

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

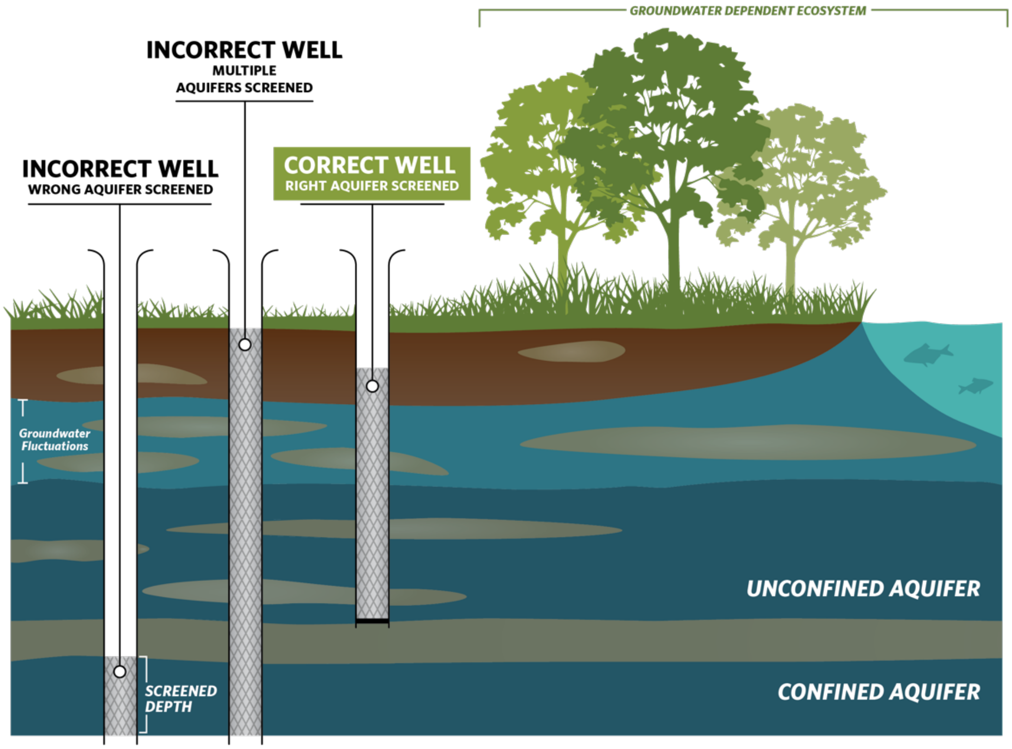

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

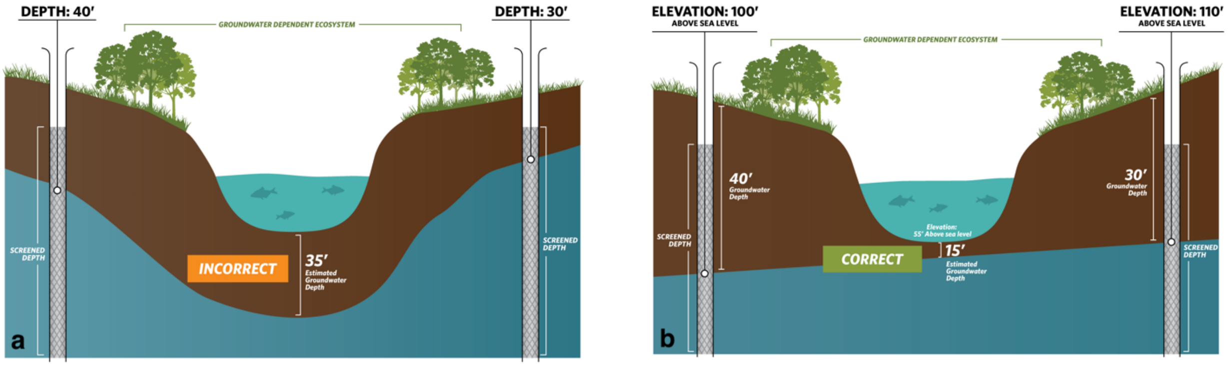

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

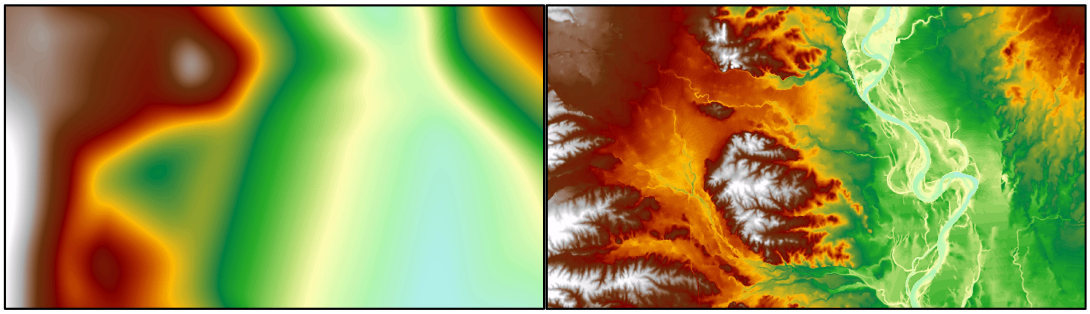

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

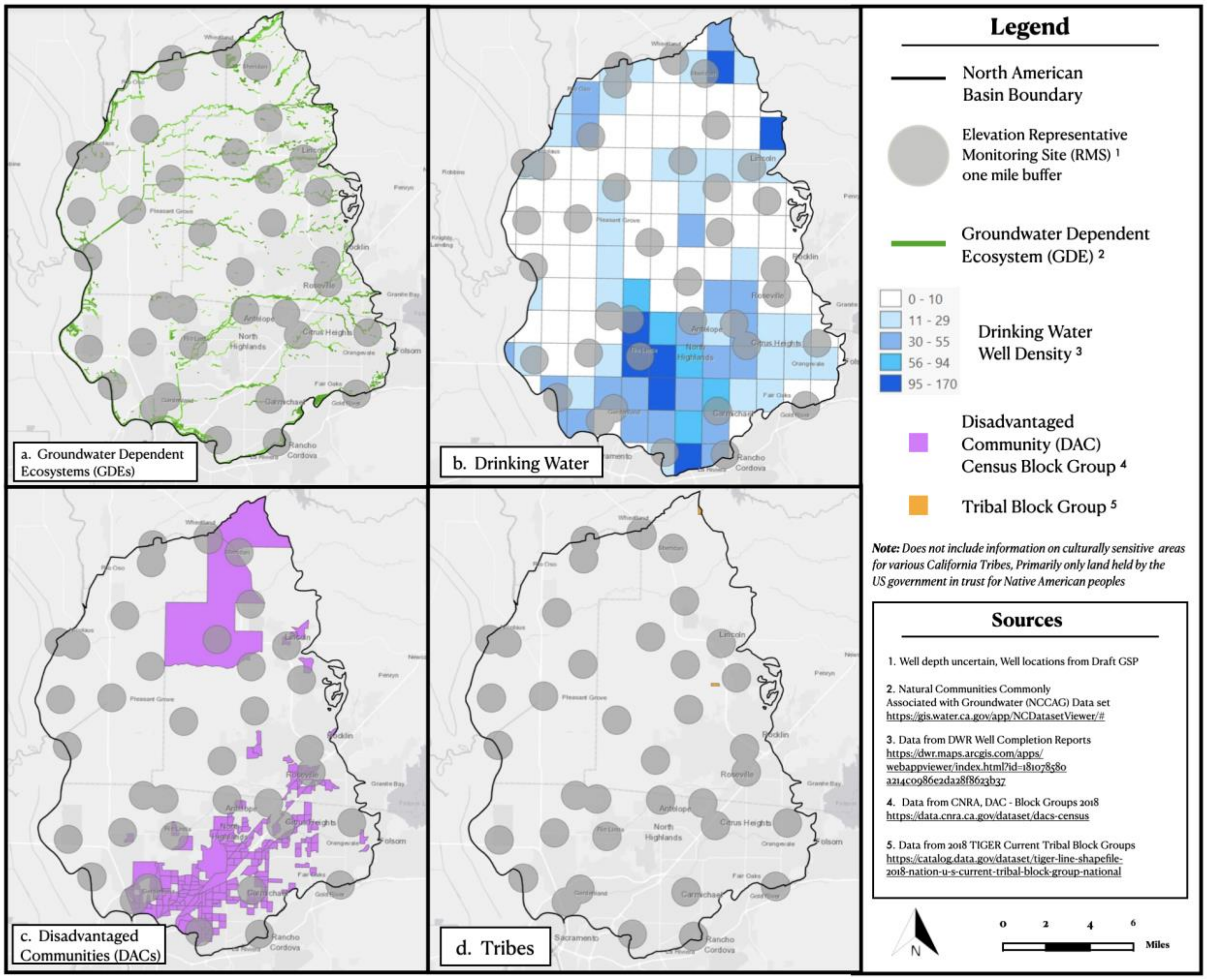

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

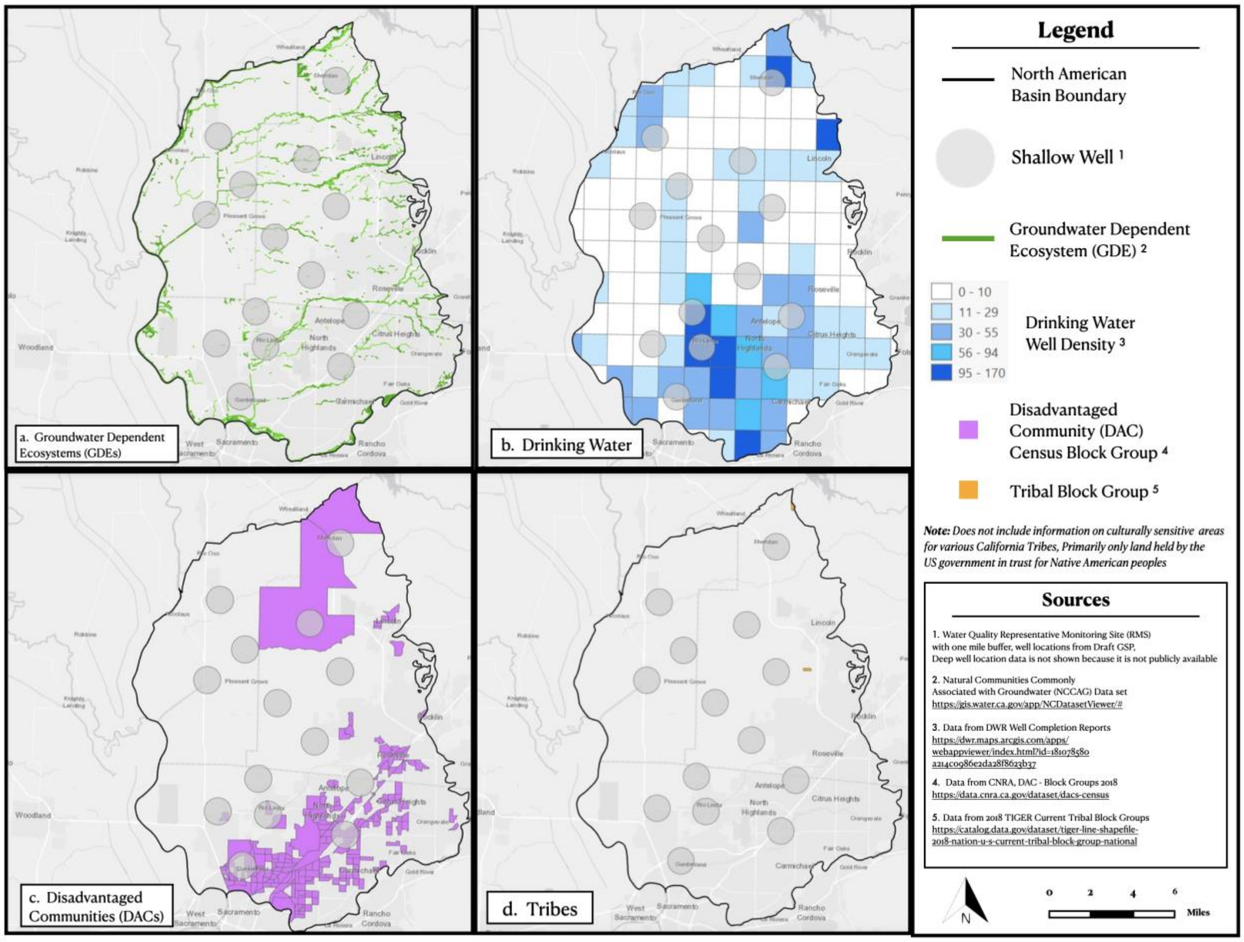

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

October 27, 2021

San Benito County Water District
30 Mansfield Road
Hollister, CA 95023

Submitted via web: https://www.sbcwd.com/gsp-development/

Re: Public Comment Letter for North San Benito Basin Draft GSP

Dear Jeff Cattaneo,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the North San Benito Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.

2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the North San Benito Basin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the North San Benito Basin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. The GSP provides information about DACs, including identification by name and location on a map. However, it was unclear whether DACs were identified by using US Census places, tracts, or block group data. The GSP fails to document the population of each DAC, and fails to include the population dependent on groundwater as their source of drinking water in the basin.

While the plan provides a density map of domestic wells in the basin, the GSP fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the basin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Indicate the level of geographic boundaries for DACs (i.e., US Census places, tracts, or block groups). • Describe the population of each identified DAC. • Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

- Include a map showing domestic well locations and average well depth across the basin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP describes the use of streamflow measurements from the late 1990s and early 2000s to identify the pattern of gaining and losing reaches in the basin. The GSP also describes available depth-to-groundwater data, but provides the caveat (p. 4-18): *"However, available data are of limited use for this purpose due to insufficient geographic and vertical coverage. Available data are almost entirely from water supply wells, which are typically screened 200 to 500 feet below the ground surface. The groundwater elevation (potentiometric head) at the depth of the well screen can be different from the true water table, which is the first zone of saturation reached when drilling down from the ground surface."* The GSP presents contours of depth to groundwater in fall 2017, but contours from this single date are the only data presented.

The GSP presents conflicting conclusions for the ISW analysis. Figure 4-22 (Surface Water Connected to Groundwater) shows gaining and losing reaches in the basin, implying that all reaches in the basin are interconnected. However, Figure 6-6 (Depth to Water October 1992 and April 1998) shows a smaller subset of stream reaches labeled as potentially connected to groundwater. The latter figure is presented in Chapter 6 (Sustainable Management Criteria), not Section 4.11 (Interconnection of Surface Water and Groundwater).

RECOMMENDATIONS

- Provide a map showing all the stream reaches in the basin, with reaches clearly labeled as interconnected (gaining and losing) or disconnected. Present this map in Section 4.11 (Interconnection of Surface Water and Groundwater), not Chapter 6 (Sustainable Management Criteria). Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.

- Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.

- Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems
The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of comprehensive, systematic analysis of the basin's GDEs. The GSP provides general discussion of riparian vegetation and depth to groundwater. In addition, the GSP presents an empirical method for relating vegetation health to groundwater elevations in wells, comparing aerial photographs of phreatophytic riparian vegetation before and after droughts. The GSP states (p. 4-22): *"The general conclusion that can be drawn from the pre- and post-drought aerial photograph comparison is that riparian vegetation tends to persist even when groundwater elevations in nearby water supply wells are 35 to 40 feet below the ground surface for a period of two years."* No shallow groundwater data was used to verify the NC dataset polygons, however. The GSP does not provide an overall map of the basin's GDEs illustrating the conclusions of the GDE analysis.

RECOMMENDATIONS
● Develop and describe a systematic approach for analyzing the basin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained or removed from the NC dataset (and the removal reason if polygons are not considered potential GDEs). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. ● Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. ● Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape. ● If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network. ● Provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the basin and note any threatened or endangered species (see Attachment C in this letter for a list of freshwater species located in the North San Benito Basin). The GSP text discusses plant and animal species dependent on groundwater, but does not provide a complete inventory in tabular form.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of these ecosystems into the water budget is **insufficient**. The water budget did explicitly include the current, historical, and projected demands of native vegetation, but did not explicitly include the current, historical, and projected demands of managed wetlands. The GSP discusses managed wetlands, the Pajaro River Wetland Mitigation Bank, on p. 2-5 of the GSP. The omission of explicit water demands for managed wetlands is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

RECOMMENDATION
• Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including managed wetlands.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Communication Plan (Appendix D).[4]

We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement with DACs are described in general terms. They include participation through a Technical Advisory Committee, scheduled meetings, updates to the Water District website, and public workshops. Preliminary ideas for engaging DACs are described, including using "food, faith, and festivals" as opportunities to educate and interact with San Benito County Water District's Spanish speaking community on critical issues, connecting with communities through existing organizations, community events, churches, and schools, and developing bilingual materials. However, it is not clear if these strategies have been implemented.

- Organizations that represent environmental uses of groundwater are mentioned in the GSP, but specific outreach targeted to these groups is not described.

- The Communication Plan does not include a plan for continual opportunities for engagement through the implementation phase of the GSP for DACs, domestic well owners, and environmental stakeholders.

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[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

RECOMMENDATION

- In the Communication Plan, describe active and targeted outreach to engage DAC members, domestic well owners, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the basin within the GSP.[5]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, minimum thresholds are initially set at historical groundwater level lows and then adjusted upward to be more protective. The GSP acknowledges the impact of minimum thresholds on DACs, by stating justification of the minimum threshold levels as (p. 6-8): *"Upward adjustment to be protective in the San Juan Economically Disadvantaged Area."* The GSP does not state what the impacts of the minimum thresholds to DACs and drinking water users would be, however, when describing undesirable results.

The GSP recognizes that domestic wells could be impacted by groundwater management in the basin. The GSP states (p. 6-6): *"In North San Benito, some concern exists that some recent wells might be relatively shallow because they were constructed during a period when groundwater levels have been maintained at relatively high levels."* The GSP does not attempt to quantify this impact, however. Thus, the GSP does not sufficiently analyze direct and indirect impacts on drinking water users when defining undesirable results, or evaluate the cumulative or indirect impacts of proposed minimum thresholds on drinking water users.

The GSP identifies the constituents of concern (COCs) in the basin for which SMC have been established as total dissolved solids (TDS) and nitrate. Other potential COCs in the basin include perchlorate, selenium, hardness, boron, iron, manganese, arsenic, and chromium. The GSP states (p. 6-28): *"Sustainable criteria have not been developed in this GSP for these constituents*

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[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

because they are already managed under existing programs or because they are naturally occurring and unlikely to be affected by GSP management actions." However, SMC should be established for all COCs in the basin that may be impacted and/or exacerbated by groundwater use or management, in addition to coordinating with water quality regulatory programs. Naturally occurring COCs can be exacerbated as a result of groundwater use or groundwater management within the basin.

RECOMMENDATIONS
Chronic Lowering of Groundwater Levels ● Describe direct and indirect impacts on DACs and drinking water users when describing undesirable results for chronic lowering of groundwater levels. ● Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs and drinking water users within the basin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold. **Degraded Water Quality** ● Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[9] ● Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users. ● Set minimum thresholds and measurable objectives for water quality constituents within the basin, including naturally occurring constituents that can be exacerbated as a result of groundwater use or groundwater management. Ensure they align with drinking water standards.[10]

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts to GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the basin, they must be considered when developing SMC for chronic lowering of groundwater levels. Our comments above in the GDE section note that shallow groundwater data was not used to verify the NC dataset polygons, therefore the GSP may have disregarded some GDEs in the basin. After re-analyzing GDEs based on our comments above, consider potential impacts to GDEs for the chronic lowering of groundwater levels sustainability indicator.

[9] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[10] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

In the depletion of interconnected surface water SMC section of the GSP (Section 6.7), the GSP discusses impacts to beneficial users of groundwater and surface water. The GSP uses a water table depth of 20 feet as an estimate of the maximum depth accessed by riparian vegetation, citing typical rooting depths for some phreatophytes in the basin. However, valley oak (*Quercus lobata*) can access groundwater at depths as deep as 80 feet.[11,12] The GSP also does present some discussion of potential causes of undesirable results to GDEs, using aerial photos and measures of vegetative health (i.e., NDVI and NDMI). The GSP does not, however, state how this analysis helps to inform the development of SMC that are protective of terrestrial GDEs.

To establish SMC for depletion of interconnected surface water, the GSP sufficiently discusses impacts to aquatic GDEs. Section 6.7.2. Potential Causes of Undesirable Results presents a modeling analysis to determine the impacts of changes in regional groundwater pumping on passage opportunity for migrating fish. The GSP includes a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached. The GSP states (p. 6-48): "*The minimum threshold is expected to protect beneficial uses of surface water for aquatic and riparian habitat maintenance. The few springs in the interior of the basin that could plausibly be affected by pumping (along Tequisquita Slough and San Juan Creek) are on the upgradient side of the Calaveras and San Andreas faults, where shallow water levels are relatively stable. Along stream reaches in red-legged frog habitat (San Benito River upstream of Bird Creek and Tres Pinos Creek between Tres Pinos Creek Valley and Southside Road), the lowest simulated water levels in the future baseline scenario were under 1992 conditions and were equal to or higher than historical water levels at that time.*"

RECOMMENDATIONS

- Analyze depth to water data and rooting depth data for GDEs in the GDE identification section of the GSP, in addition to the sustainable management criteria section. Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as valley oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater.

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the basin.

[11] Lewis, D.C. and Burgy, R.H. 1964. The relationship between oak tree roots and groundwater in fractured rock as determined by tritium tracing. Journal of Geophysical Research, 69(12), pp.2579-2588.
[12] Howard, Janet L. 1992. Quercus lobata. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/plants/tree/quelob/all.html [2021, October 8].

Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[13,14]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[15] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[16] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the basin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

The GSP includes climate change into key inputs (e.g., precipitation, evapotranspiration, and surface water flow) of the projected water budget. However, the sustainable yield is based on the projected water budget under baseline conditions. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

[13] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[14] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[15] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]
[16] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

RECOMMENDATIONS
• Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions. • Calculate sustainable yield based on the projected water budget with climate change incorporated. • Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs and domestic wells.

Figure 7-1 (Groundwater Level Key Wells, Dedicated and Other Monitoring Wells) and Figure 7-4 (Wells in the SBCWD Water Quality Monitoring Program) show that no monitoring wells are located across portions of the basin near DACs and domestic wells. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[17]

The GSP provides discussion of data gaps for GDEs and ISWs, including proposed GDE-related biological monitoring, in Sections 6.7.7.1 (Discussion of Monitoring and Management Measures to be Implemented), Section 7.1.6 (Depletion of Interconnected Surface Water), and Section 8.10.2 (Project Implementation).

RECOMMENDATION
• Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, GDEs, and ISWs to clearly identify potentially impacted areas. Increase the number of RMSs in the shallow aquifer across the basin as needed to adequately monitor all groundwater condition indicators. Prioritize proximity to DACs and domestic wells when identifying new RMSs.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

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[17] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

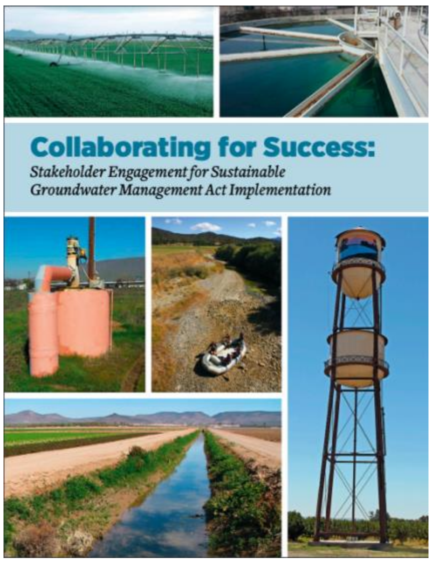
RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.
- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.
- The GSP discusses potential options for additional surface water storage. Note that recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[18]
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[18] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B
SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

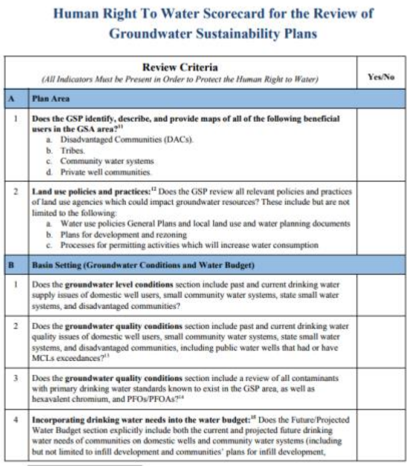
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

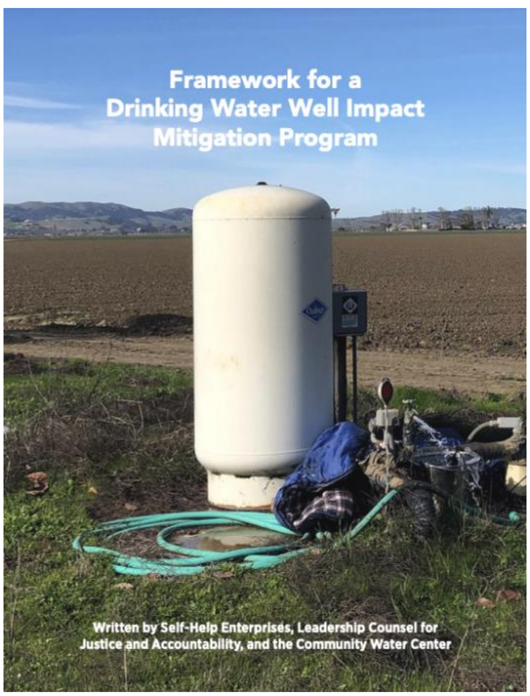


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

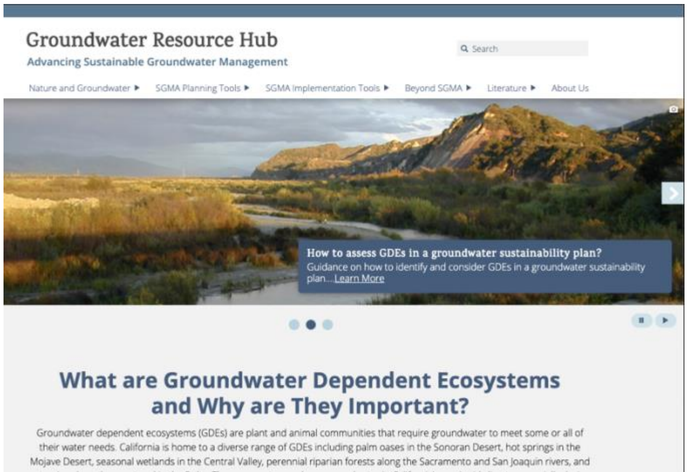
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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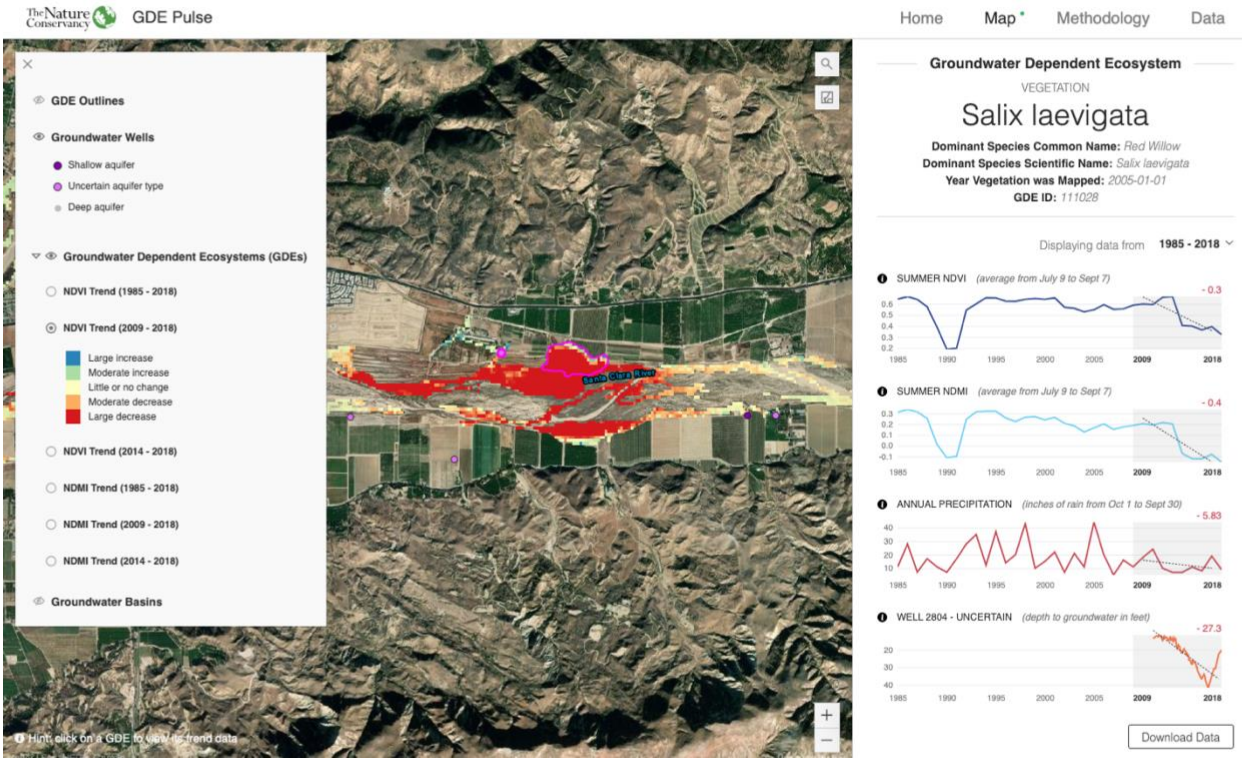
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

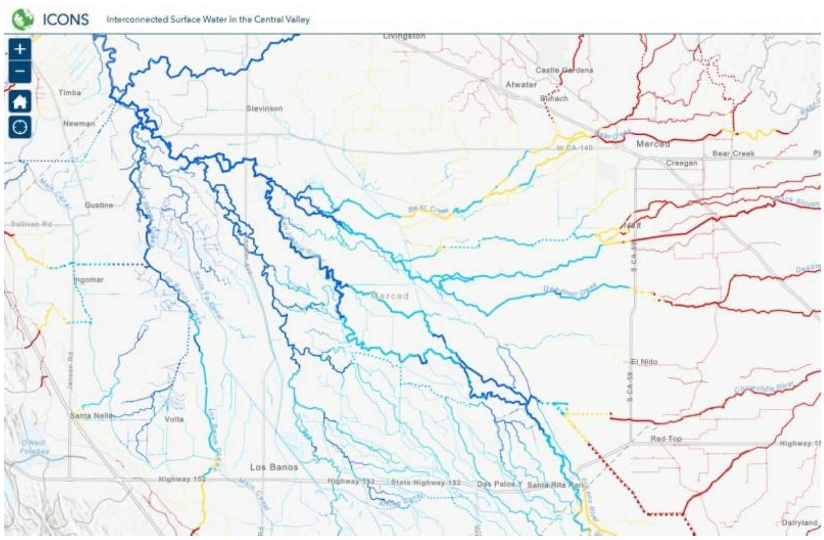
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the San Benito River Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the San Benito River Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Anas americana	American Wigeon			
Anas crecca	Green-winged Teal			
Anas platyrhynchos	Mallard			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Bucephala albeola	Bufflehead			
Butorides virescens	Green Heron			
Calidris minutilla	Least Sandpiper			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Megaceryle alcyon	Belted Kingfisher			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Oxyura jamaicensis	Ruddy Duck			
Phalacrocorax auritus	Double-crested Cormorant			
Podilymbus podiceps	Pied-billed Grebe			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Hyalella spp.	Hyalella spp.			
FISH				
Oncorhynchus mykiss - SCCC	South Central California coast steelhead	Threatened	Special Concern	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Anaxyrus boreas halophilus	California Toad			ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
Pseudacris sierra	Sierran Treefrog			

Thamnophis sirtalis fitchi	Valley Gartersnake			Not on any status lists
Thamnophis sirtalis infernalis	California Red-sided Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Optioservus canus	Pinnacles Optioservus Riffle Beetle		Special	
Sweltsa tamalpa	Tamalpais Sallfly			
Acentrella spp.	Acentrella spp.			
Agabus spp.	Agabus spp.			
Ambrysus spp.	Ambrysus spp.			
Apedilum spp.	Apedilum spp.			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetidae fam.	Baetidae fam.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Brillia spp.	Brillia spp.			
Caenis bajaensis	A Mayfly			
Centroptilum spp.	Centroptilum spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Coenagrionidae fam.	Coenagrionidae fam.			
Conchapelopia spp.	Conchapelopia spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Cryptotendipes spp.	Cryptotendipes spp.			
Dicrotendipes modestus				Not on any status lists
Erpetogomphus spp.	Erpetogomphus spp.			
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Gumaga spp.	Gumaga spp.			
Gyrinus spp.	Gyrinus spp.			
Hetaerina americana	American Rubyspot			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ischnura denticollis	Black-fronted Forktail			
Ischnura perparva	Western Forktail			
Lepidostoma spp.	Lepidostoma spp.			

Limnophyes spp.	Limnophyes spp.			
Microcylloepus spp.	Microcylloepus spp.			
Micropsectra spp.	Micropsectra spp.			
Microtendipes spp.	Microtendipes spp.			
Nectopsyche spp.	Nectopsyche spp.			
Neotrichia spp.	Neotrichia spp.			
Ochrotrichia spp.	Ochrotrichia spp.			
Paltothemis lineatipes	Red Rock Skimmer			
Pantala hymenaea	Spot-winged Glider			
Parametriocnemus spp.	Parametriocnemus spp.			
Paratendipes spp.	Paratendipes spp.			
Peltodytes spp.	Peltodytes spp.			
Pentaneura spp.	Pentaneura spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			
Postelichus spp.	Postelichus spp.			
Psephenus falli				Not on any status lists
Pseudochironomus spp.	Pseudochironomus spp.			
Radotanypus spp.	Radotanypus spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Sialis spp.	Sialis spp.			
Sigara mckinstryi	A Water Boatman			Not on any status lists
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sympetrum madidum	Red-veined Meadowhawk			
Tanytarsus spp.	Tanytarsus spp.			
Tricorythodes spp.	Tricorythodes spp.			
MOLLUSKS				
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
PLANTS				
Azolla filiculoides	NA			
Baccharis salicina				Not on any status lists
Berula erecta	Wild Parsnip			
Callitriche marginata	Winged Water-starwort			
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus squarrosus	Awned Cyperus			

Datisca glomerata	Durango Root			
Elatine californica	California Waterwort			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis parishii	Parish's Spikerush			
Eleocharis rostellata	Beaked Spikerush			
Euthamia occidentalis	Western Fragrant Goldenrod			
Helenium puberulum	Rosilla			
Hydrocotyle umbellata	Many-flower Marsh-pennywort			
Juncus effusus pacificus				
Juncus phaeocephalus paniculatus	Brownhead Rush			
Juncus xiphioides	Iris-leaf Rush			
Lemna minor	Lesser Duckweed			
Lemna valdiviana	Pale Duckweed			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limosella aquatica	Northern Mudwort			
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus guttatus	Common Large Monkeyflower			
Mimulus pilosus				Not on any status lists
Montia fontana fontana	Fountain Miner's-lettuce			
Perideridia californica	California Yampah			
Phacelia distans	NA			
Platanus racemosa	California Sycamore			
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton nodosus	Longleaf Pondweed			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rumex salicifolius salicifolius	Willow Dock			
Salix exigua exigua	Narrowleaf Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Scirpus microcarpus	Small-fruit Bulrush			
Stachys albens	White-stem Hedge-nettle			
Stachys pycnantha	Short-spike Hedge-nettle			
Typha domingensis	Southern Cattail			

Veronica anagallis-aquatica	NA			
Veronica catenata	NA			Not on any status lists

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

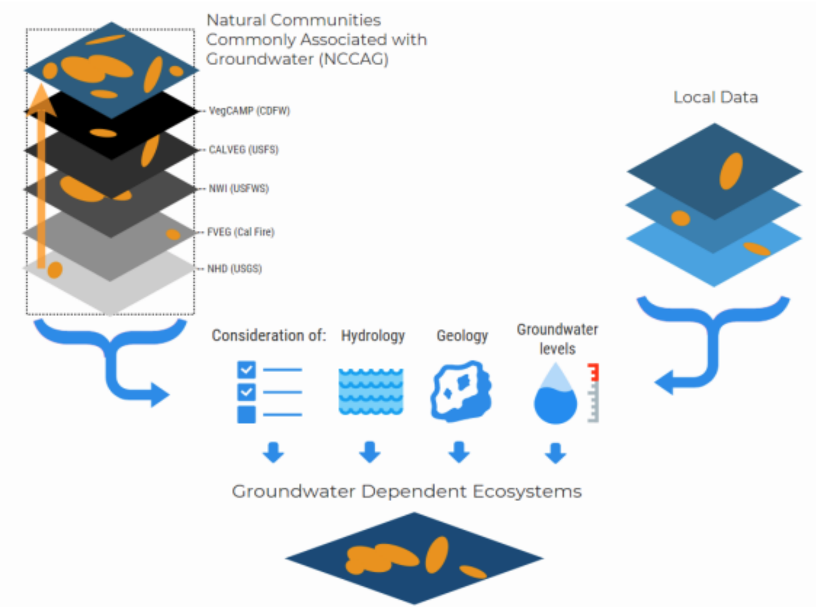


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

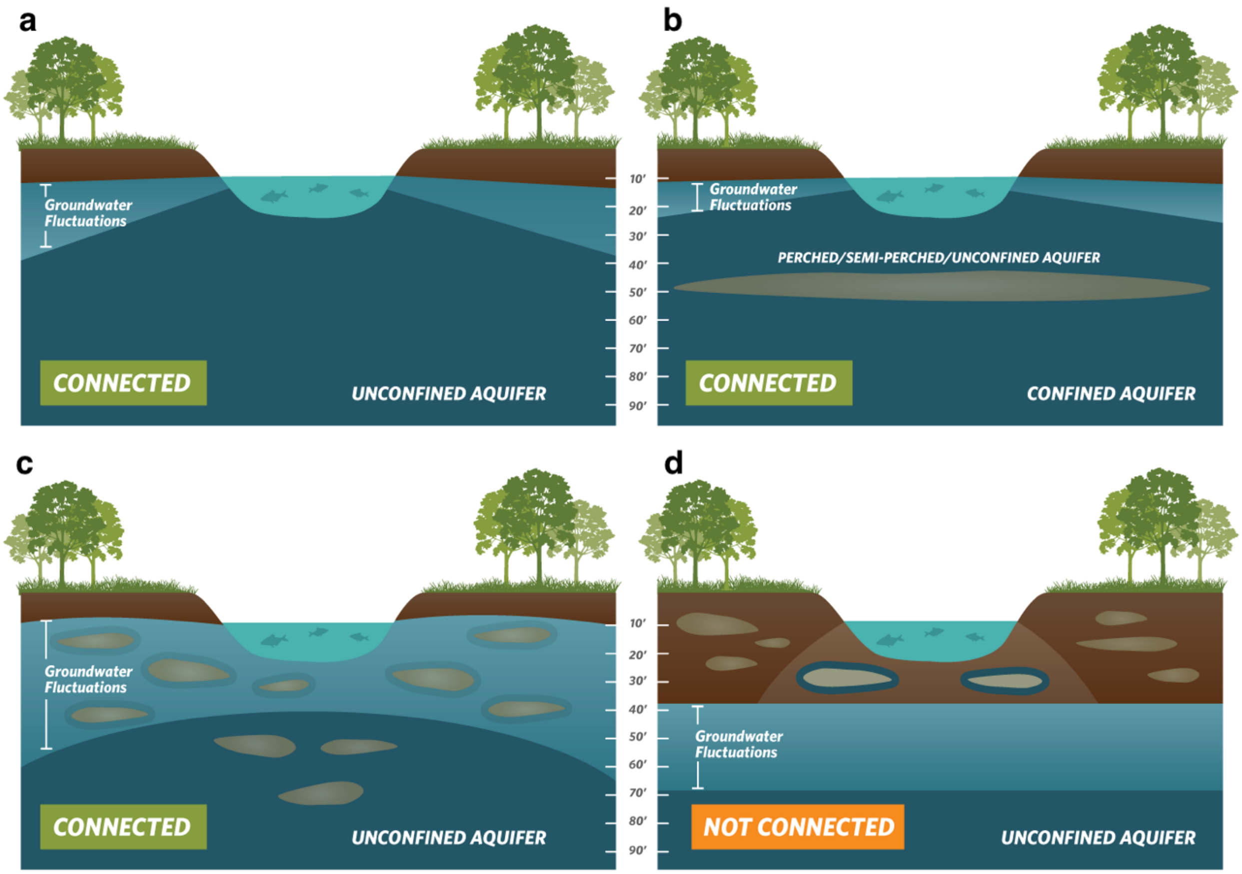


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

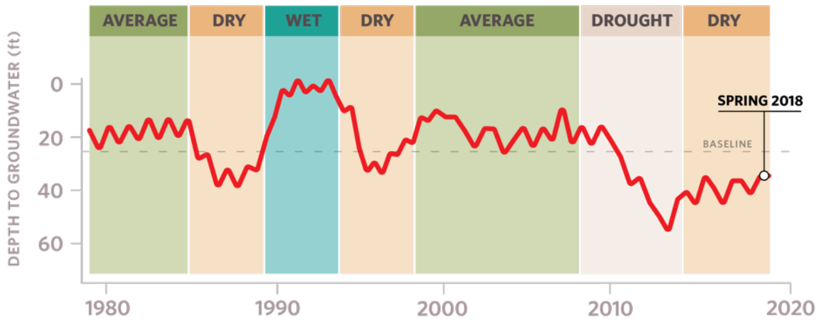


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

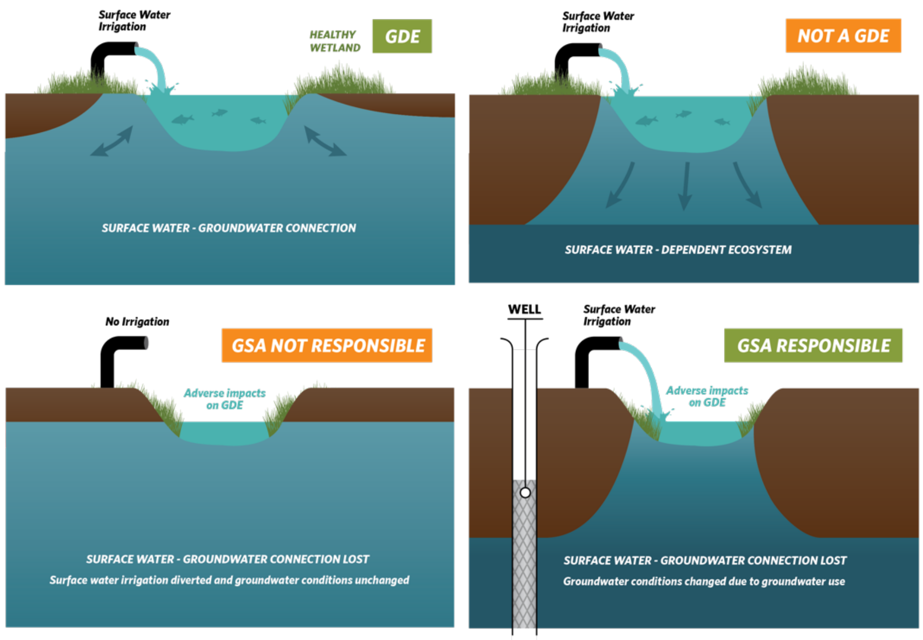

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

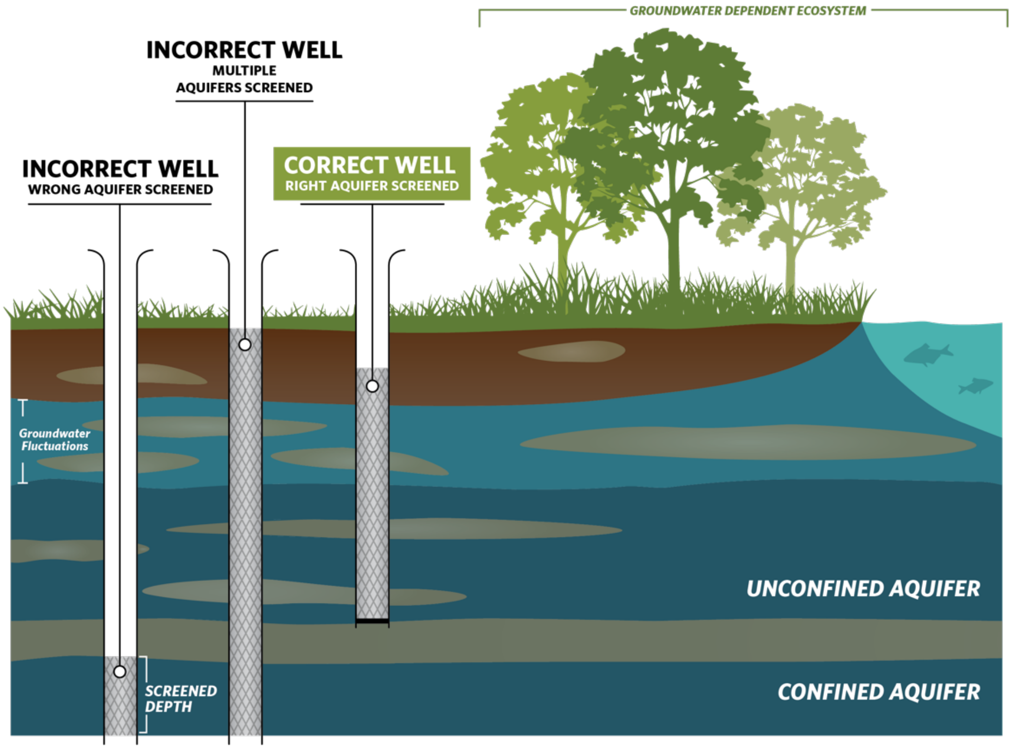

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

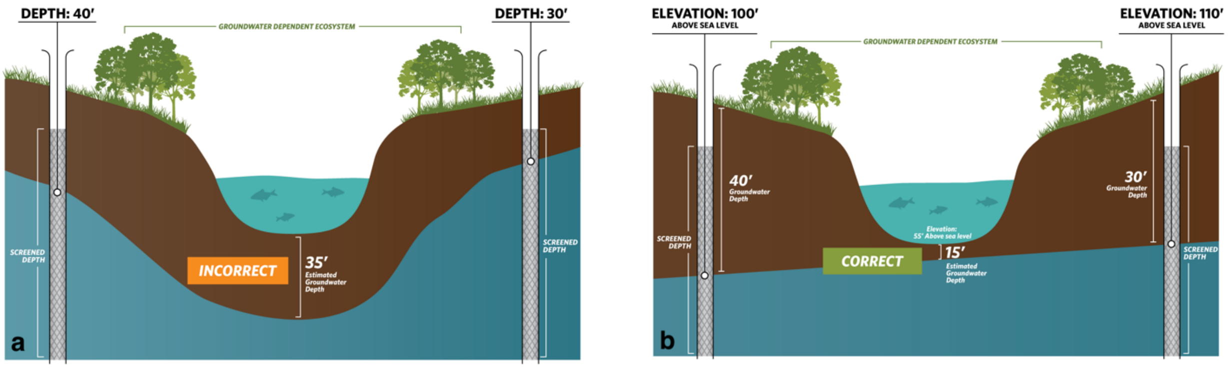

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

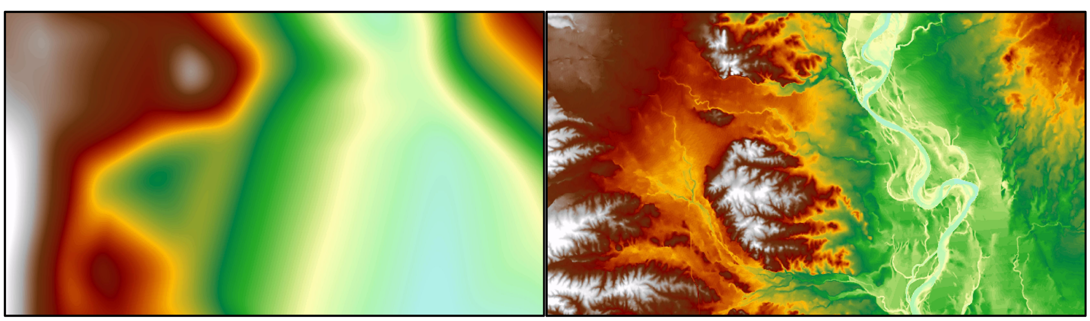

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

December 9, 2021

Ojai Basin Groundwater Management Agency
P.O. Box 1779
Ojai, CA 93024

Submitted via email: OjaiBasinGSP@gmail.com

Re: Public Comment Letter for Ojai Valley Groundwater Basin Draft GSP

Dear John Mundy,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Ojai Valley Groundwater Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.

2. Climate change **is not sufficiently** considered.
3. Data gaps **are sufficiently** identified and the GSP **has a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Ojai Valley Groundwater Basin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Ojai Valley Groundwater Basin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. The GSP identifies the Barbareño/Ventureño Band of Mission Indians as a stakeholder within the basin but does not provide a map of the tribal lands or tribal interests in the basin.

The GSP maps domestic wells in the basin by density per square mile (Figure 2-5). However, the plan fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the basin. This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the basin.

These missing elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Include a map showing domestic well locations and average well depth across the basin. • Provide a map of tribal lands and describe tribal interests in the basin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis.

The GSP maps streams in the basin using the USGS National Hydrography Dataset on Figure 2-36, which shows the stream reaches labeled as intermittent, perennial, and unclassified. The

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

GSP states (p. 2-137): "*According to the USGS National Hydrography Dataset (NHD), nearly the entire length of every creek that transects the OVGB is classified as intermittent within the OVGB, with the exception of the lowermost reaches of San Antonio Creek, Thacher Creek, and the Fox Canyon Drain/Stewart Canyon drainage which are classified as perennial.*" Note the regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted." "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

The GSP implies that surface water reaches connected to the shallow perched aquifer should not be considered ISWs. The GSP states (p. 2-137): *"Based on available lithologic, streamflow, and groundwater level data, there is a shallow perched aquifer in the southern and western portion of the OVGB that is in hydraulic connection with surface water of San Antonio Creek and its tributaries. The shallow perched aquifer is separated from the deeper confined production aquifers by an extensive clay aquitard (OBGMA 2018). Groundwater levels in the shallow perched aquifer exhibit a stable trend with little seasonal fluctuation or response to groundwater extraction while groundwater levels in the principal aquifer show the effects of groundwater extraction."* However, shallow aquifers that provide significant quantities of groundwater to springs or surface water systems, must by definition be considered a principal aquifer, regardless of pumping.[2] This is especially the case if the shallow aquifer is supporting ecosystems, providing baseflow to streams, and has the potential to support future well development, even if the majority of the basin's pumping is currently occurring in deeper principal aquifers. If areas of shallow or perched groundwater are discounted as ISWs, the GSP should provide more supporting evidence of 1) vertical groundwater gradients between the perched system and deeper principal aquifers, and 2) whether perched groundwater is providing significant or economic quantities of water to springs (e.g., GDEs), wells (e.g., domestic wells), and surface water systems (e.g., GDEs/ISWs).

The GSP acknowledges the gaps in data needed to adequately characterize the interaction between groundwater and surface water within the basin. We recommend that any segments with data gaps are considered potential ISWs and clearly marked as such on maps provided in the GSP.

RECOMMENDATIONS

- On the map of streams in the basin, clearly label reaches as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.
- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.
- Overlay the basin's stream reaches on depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis.

[2] "'Principal aquifers' refer to aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems." [23 CCR §351(aa)]

- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, we found that some mapped features in the NC dataset were improperly disregarded.

- NC dataset polygons were incorrectly removed if Normalized Difference Vegetation Index (NDVI) and Normalized Difference Moisture Index (NDMI) data did not correlate with groundwater level trends. This is an incorrect method, since a lack of a relationship does not preclude that groundwater is providing some of the ecosystem's water needs. If the ecosystem is accessing groundwater then the ecosystem should be categorized as a GDE. If there are no data to characterize groundwater conditions underlying the GDE, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP.

- NC dataset polygons were incorrectly removed if they were determined to not be impacted by groundwater extraction from the deeper principal aquifer. However, shallow aquifers that have the potential to support well development, springs, or surface water systems are principal aquifers, even if the majority of the basin's pumping is occurring in deeper principal aquifers. If there are no data to characterize groundwater conditions in the shallow principal aquifer, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP.

The GSP states (p. 2-147): *"Of the 46 individual vegetation and wetland communities (253.3 acres) identified in the NCCAG dataset, 12 communities (94.3 acres) are characterized as priority potential groundwater dependent ecosystems, 21 communities (99.5 acres) are characterized as potential groundwater dependent ecosystems, and 13 communities (59.5 acres) are characterized as potential GDEs not likely impacted by groundwater extraction."* The GSP should clarify which potential GDEs are retained for consideration and inclusion in the monitoring network and sustainable management criteria. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

The GSP lists Valley Oak (*Quercus lobata*) as one of the vegetation types in the basin. We recommend that an 80-foot depth-to-groundwater threshold be used when inferring whether Valley Oak polygons in the NC dataset are likely reliant on groundwater. This recommendation is based on a recent correction in TNC's rooting depth database,[3] after finding a typo in the max rooting depth units for Valley Oak. This resulted in a specific change in the max rooting depth of Valley Oak from 24 feet to 24 meters (80 feet). For all other phreatophytes, we continue to recommend that a 30-foot depth-to-groundwater threshold be used when inferring whether all other NC dataset polygons are likely reliant on groundwater.

[3] TNC. 2021. Plant Rooting Depth Database. Available at: https://groundwaterresourcehub.org/sgma-tools/gde-rooting-depths-database-for-gdes/

The GSP provides a summary of the communities in the NC Dataset by vegetation and wetland type in Table 2-12. However, the GSP does not provide a description or inventory of the basin's fauna or discuss endangered, threatened, or special status species.

RECOMMENDATIONS

- Re-evaluate the NC dataset polygons that were incorrectly removed based on NDVI and NDMI trends or based on impact by groundwater extraction from the deeper principal aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as Valley Oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether Valley Oak polygons from the NC Dataset are connected to groundwater. It is important to emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and proximity to other water sources.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- Provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the basin and note any threatened or endangered species (see Attachment C in this letter for a list of freshwater species located in the Ojai Valley Basin).

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[4,5] The integration of native vegetation into the water budget is **insufficient**. The GSP text discusses evapotranspiration from riparian habitats for the historic period, but native vegetation appears to be grouped into a category with all evapotranspiration in the water budget tables. The omission of explicit water demands for native vegetation is problematic

[4] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[5] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATIONS
● Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation. ● State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development
Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Public Outreach and Engagement Plan (Appendix C).[6]

We note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement in very general terms for listed stakeholders. Public notice and engagement activities include media releases and announcements through the Ventura River Watershed Council and agricultural industry organizations, communications via email to the interested parties list, agency website posts, and physical postings at Ojai City Hall, and attendance at public meetings with opportunities for questions and comments. The GSP does not state whether there was direct engagement with drinking water users, environmental stakeholders or representatives, or whether tribal and environmental stakeholders are represented on a GSP Advisory Committee.

- The plan does not include documentation on how stakeholder input from the above-mentioned outreach and engagement was solicited, considered, and incorporated into the GSP development process.

- While the plan states: "*The local Chumash Barbareño/Ventureño Band of Mission Indians is on the list of interested parties and is invited to participate,*" there is no documentation of how outreach and engagement to the Chumash Barbareño/Ventureño Band of Mission Indians was conducted and the input from the tribe to GSP development.

[6] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- The GSP states *"the OBGMA may adjust the engagement strategy and/or provide additional outreach opportunities as needed throughout the GSP development and implementation process,"* suggesting that plans for outreach to all identified stakeholders will continue during the implementation phase of the GSP. However, the GSP does not include a detailed plan for continual opportunities for outreach and engagement through the implementation phase of the GSP that is specifically directed to domestic well owners, tribes, and environmental stakeholders within the basin.

RECOMMENDATIONS

- In the Public Outreach and Engagement Plan, describe active and targeted outreach to engage drinking water users, tribes, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Regarding the interests of tribes, the plan states that *"the OBGMA is currently working to locate the nearest contact in the Ojai Valley and expects to send information soon after the time of print of this Outreach and Engagement Plan."* Provide this information in the final plan.

- Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the basin.[7]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[8,9,10]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP establishes minimum thresholds as follows (p. 3-12): *"Maintaining groundwater levels above recorded historical low static levels at RMPs during multi year drought conditions was selected as the minimum desired threshold for groundwater elevations that would be protective of beneficial uses in the OVGB. These minimum thresholds would be protective of all potable and non-potable beneficial uses because*

[7] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[8] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[9] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[10] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

undesirable results have not historically occurred at these levels." The GSP does not quantify the number of domestic wells that could go dry, or otherwise consider or analyze the impact of minimum thresholds on domestic wells. Therefore, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users, especially given the absence of a domestic well impact mitigation plan in the GSP. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on drinking water users or tribes when defining undesirable results, nor does it describe how the groundwater level minimum thresholds are consistent with Human Right to Water policy and will avoid significant and unreasonable impacts on these beneficial users.[11]

For degraded water quality, constituents of concern (COCs) in the basin include total dissolved solids (TDS), sulfate, chloride, boron, nitrate, iron, and manganese. Minimum thresholds are established for each COC as the relevant drinking water standards specified in Title 22 of the California Code of Regulations (CCR). Measurable objectives are established for COCs that have groundwater quality objectives in the Los Angeles Basin Plan (i.e., TDS, sulfate, chloride, and boron).

The GSP only includes a very general discussion of impacts on drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds for degraded water quality. The GSP does not, however, mention or discuss direct and indirect impacts on tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels. Include information on the impacts during prolonged periods of below average water years.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users and tribes within the basin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be fully or partially de-watered at the minimum threshold.

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users and tribes when defining undesirable results for degraded water quality.[12] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[13]

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[11] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

[12] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[13] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users and tribes.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP states (p. 3-26): *"As described in Section 3.2.6, Depletions of Interconnected Surface Water, there is not sufficient information at this time to establish minimum thresholds, measurable objectives, or interim milestones for depletions of interconnected surface water or GDEs."*

The GSP discusses data gaps for GDEs and ISWs, and provides specific plans to fill these data gaps in the monitoring network and projects and management actions sections of the GSP. Despite these data gaps, the GSP could be improved by including further discussion of significant and unreasonable effects for GDEs and ISWs in the basin, including surface water beneficial users (see Attachment C for a list of environmental users in the basin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration). In the future as SMC are established for GDEs and ISWs, note our further recommendations below.

RECOMMENDATIONS

- When establishing SMC for the basin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."
- Evaluate impacts on GDEs when establishing SMC for chronic lowering of groundwater levels. When defining undesirable results, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the basin.[14] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[15]
- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the basin are reached.[16] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected

[14] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[15] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[16] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[8,17]

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[18] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[19] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for both 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the basin. While these extreme scenarios may have a lower likelihood of occurring and their consideration is not required by DWR (only suggested), their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

The GSP integrates climate change into key inputs (e.g., changes in precipitation and evapotranspiration) of the projected water budget. However, the plan fails to include surface water flow inputs (inclusive of imported water) for the projected water budget and incorporate the effects of climate change on these flows. The sustainable yield is calculated based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios and the projected climate change effects on surface water flow inputs, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, tribes, and domestic well owners.

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[17] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[18] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[19] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

RECOMMENDATIONS

- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions
- Include surface water flow inputs, inclusive of imported water, in the projected water budget and incorporate climate change effects on these flows.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **sufficient**, due to the inclusion of specific plans to increase the Representative Monitoring Wells (RMWs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around domestic wells, tribes, GDEs, and ISWs in the basin.[20]

We commend the GSA for establishing a representative monitoring network for ISW and GDEs, and for including plans to fill existing data gaps with stream monitoring and a GDE assessment to plan for additional monitoring wells and stream gauges in the future (Section 3.5.7.2).

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **incomplete**. The GSP identifies the benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs. However, projects and management actions (e.g., Develop Salt and Nutrient Management Plan) are described without a known timeline for implementation.

The GSP also fails to include a domestic well impact mitigation program to avoid significant and unreasonable loss of drinking water. We strongly recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation.

RECOMMENDATIONS

- Describe the projected timeline for implementing the Salt and Nutrient Management Plan project in Chapter 4 of the GSP.
- For DACs and domestic well owners, provide specific plans for implementation of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

[20] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

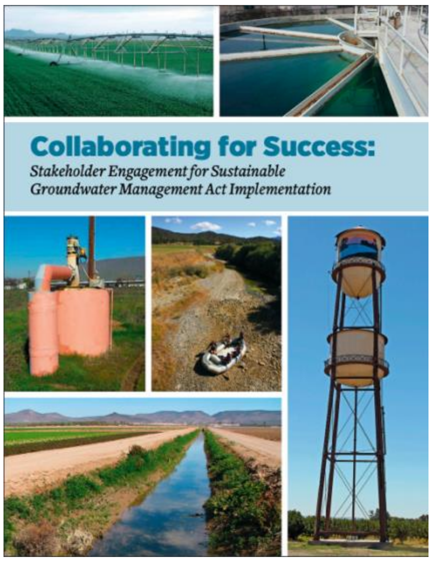
- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[21]

- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[21] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B
SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

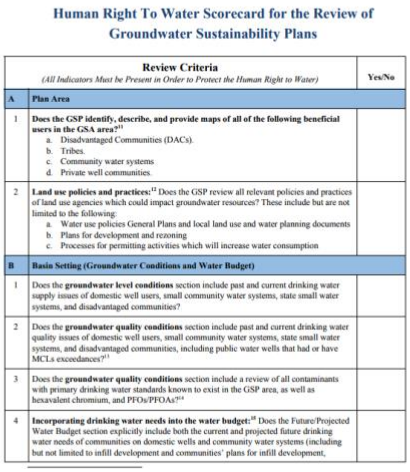
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

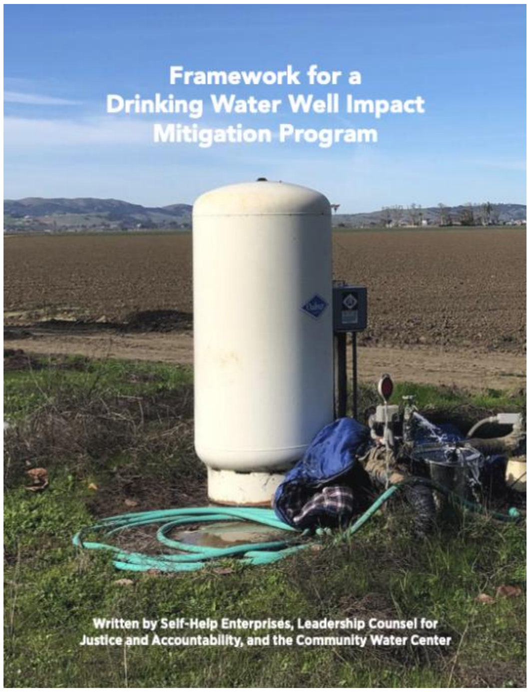


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria (All Indicators Must be Present in Order to Protect the Human Right to Water)	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

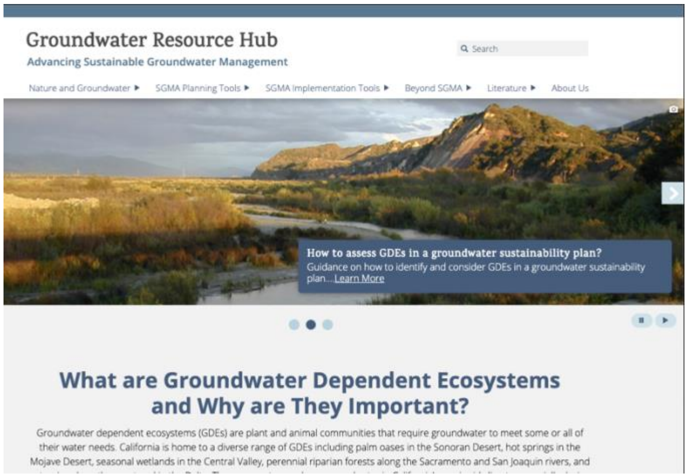
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

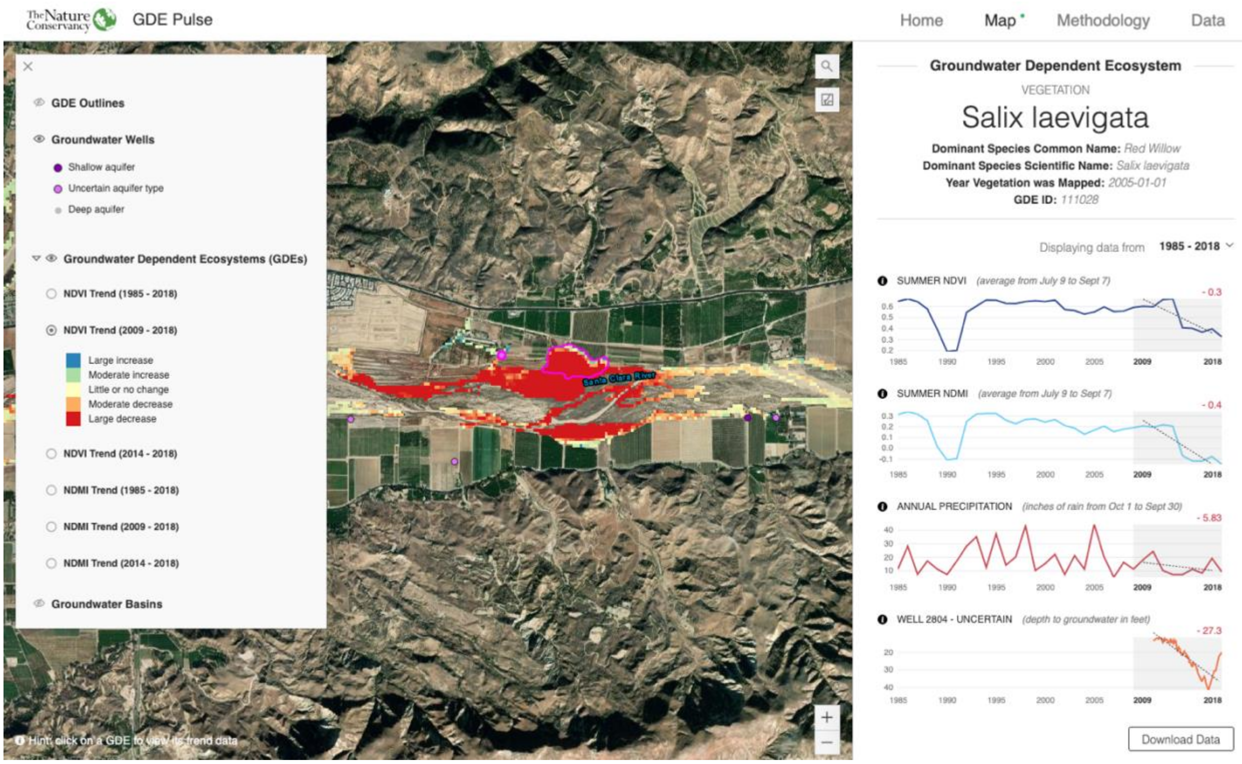
1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

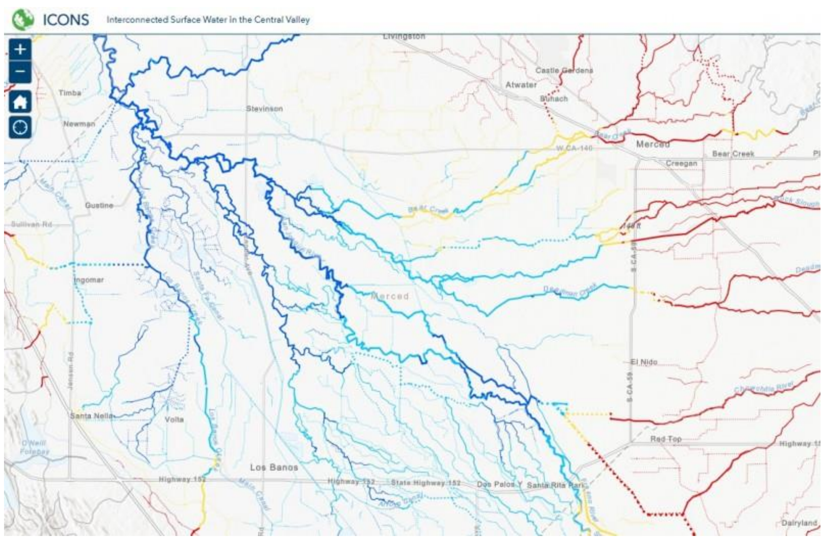
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data [available online](#) from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Ojai Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Ojai Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	**State**	**Other**
BIRDS				
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Anas americana	American Wigeon			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Nycticorax nycticorax	Black-crowned Night-Heron			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Oxyura jamaicensis	Ruddy Duck			
Phalacrocorax auritus	Double-crested Cormorant			
Podilymbus podiceps	Pied-billed Grebe			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus mykiss - Southern CA	Southern California steelhead	Endangered	Special Concern	Endangered - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Pseudacris cadaverina	California Treefrog			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Argia hinei	Lavender Dancer			
Erpetogomphus lampropeltis lampropeltis	Serpent Ringtail			
Progomphus borealis	Gray Sanddragon			
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
PLANTS				

Datisca glomerata	Durango Root			
Platanus racemosa	California Sycamore			
Salix lasiolepis lasiolepis	Arroyo Willow			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

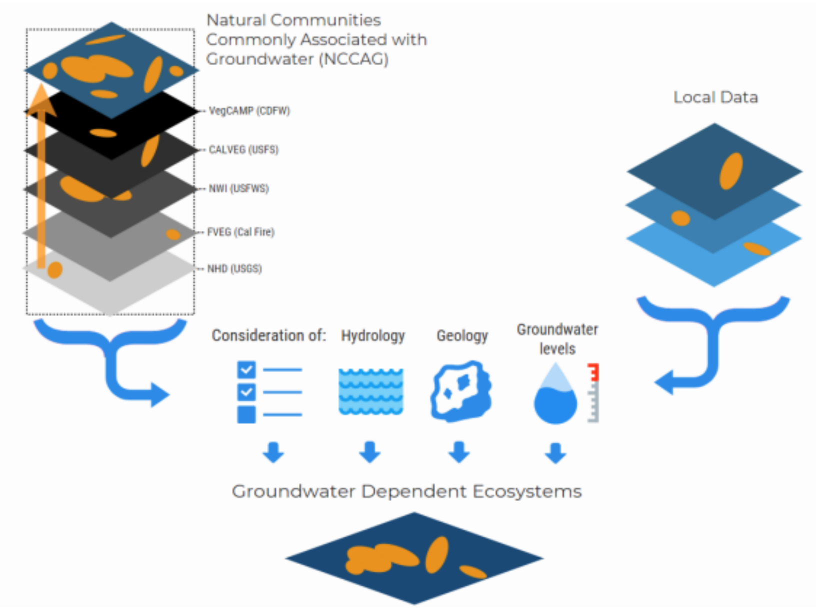


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

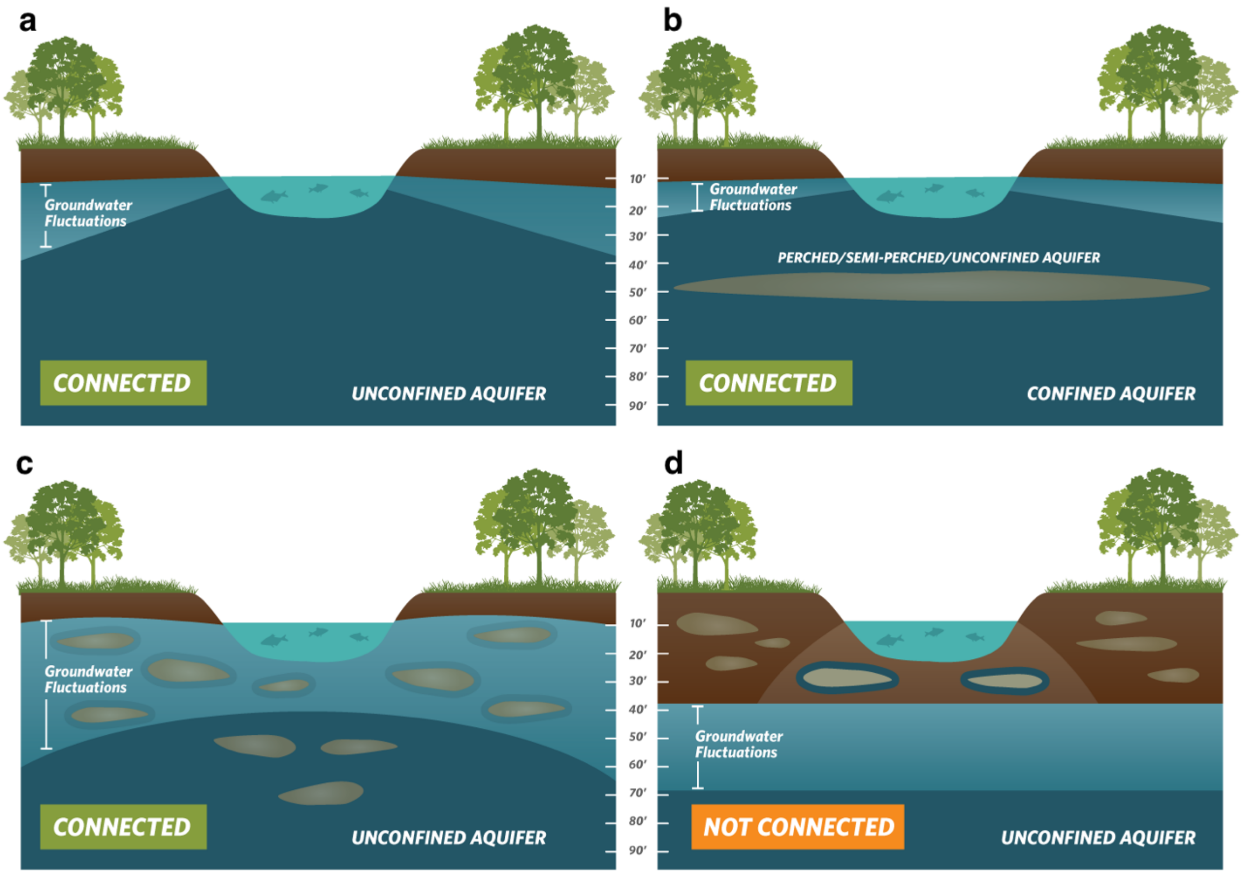

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

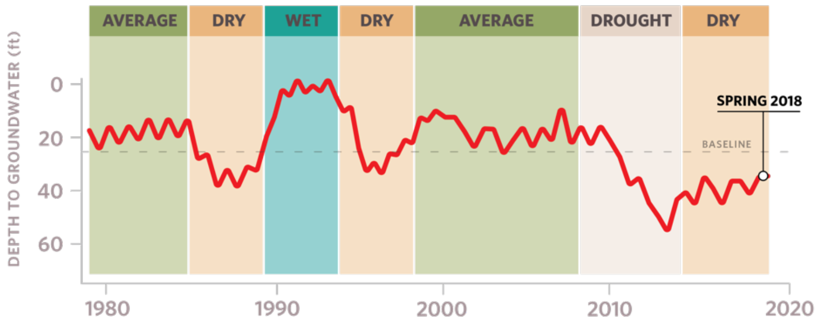

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

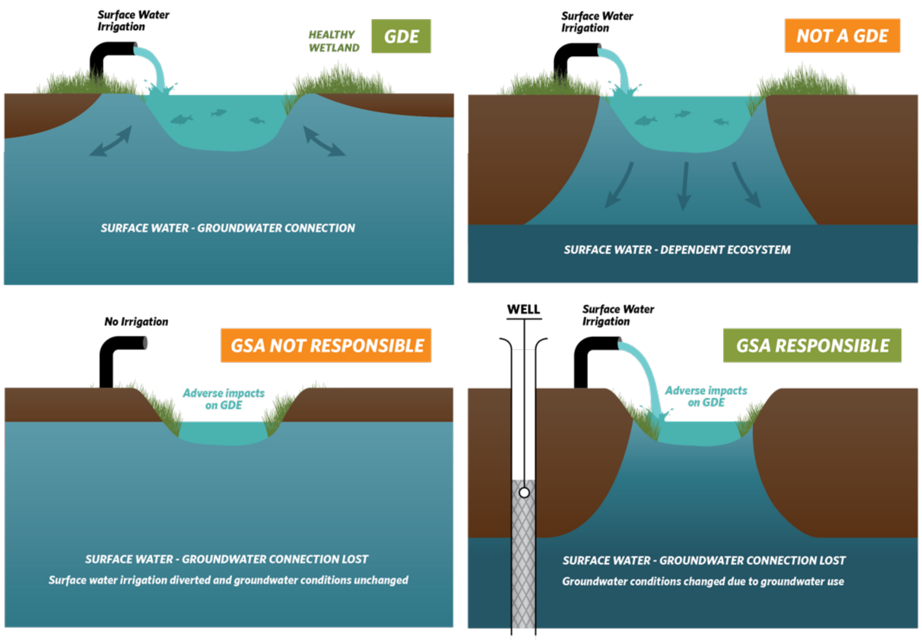

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

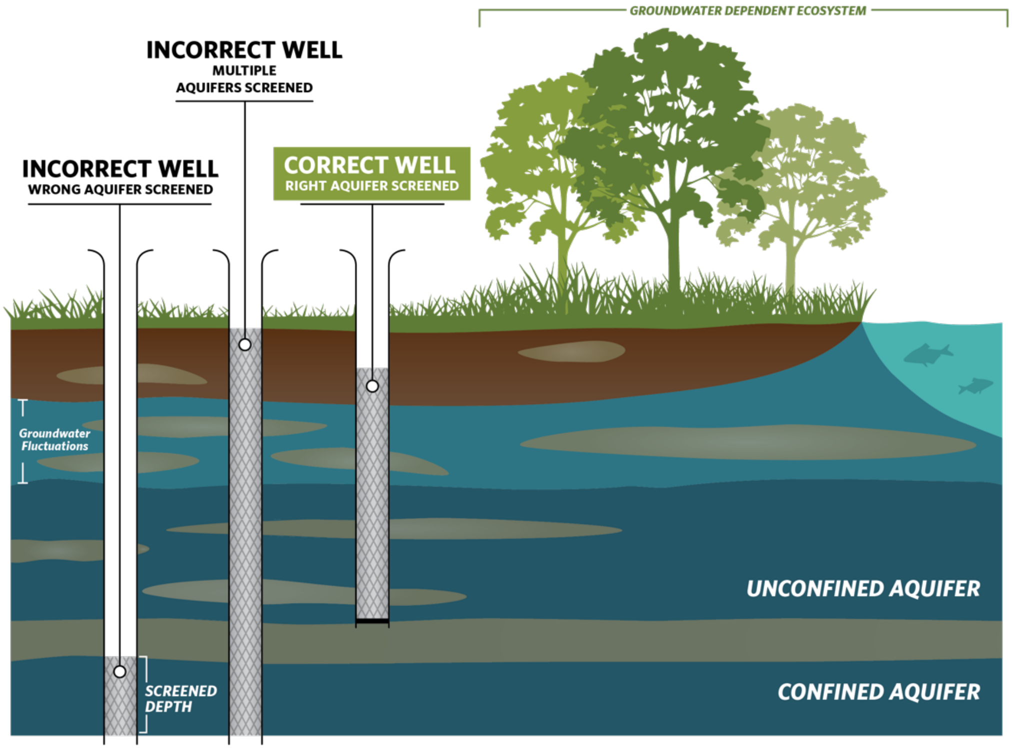

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

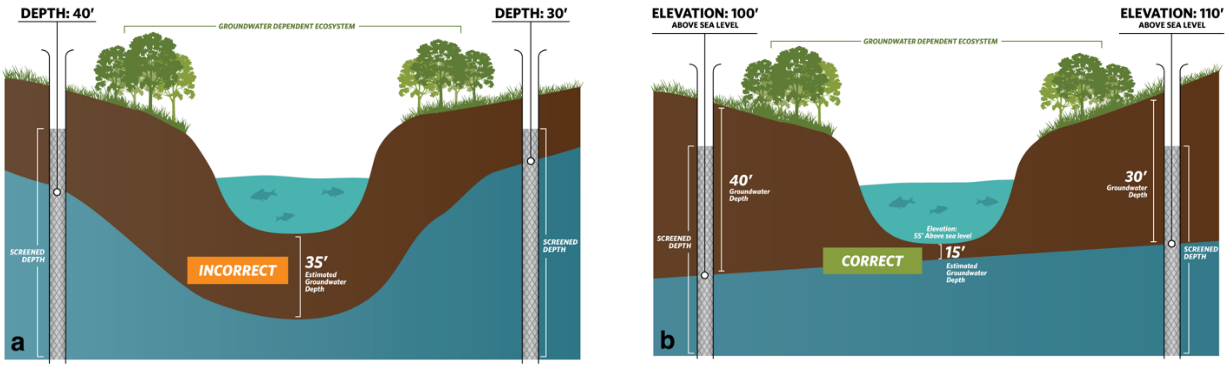

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

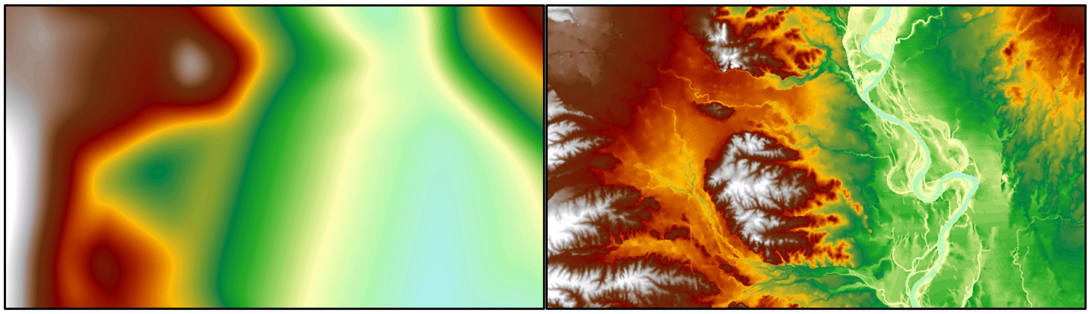

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

October 31, 2021

Petaluma Valley GSA

Submitted via web: https://petalumavalleygroundwater.org/document-comments/

Re: Public Comment Letter for Petaluma Valley Groundwater Basin Draft GSP

Dear Jay Jasperse,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Petaluma Valley Groundwater Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Petaluma Valley Groundwater Basin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

Samantha Arthur
Working Lands Program Director
Audubon California

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Danielle V. Dolan
Water Program Director
Local Government Commission

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Petaluma Valley Groundwater Basin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. The GSP discounts DACs in the basin with the statement that only one percent is categorized as a DAC (Appendix 1-E, p. 5). We note the following deficiencies with the identification of these key beneficial users:

- The plan fails to identify DACs by name, provide their location on a map, or provide the population of each DAC. The plan fails to explicitly identify the population of DACs dependent on groundwater as their source of drinking water in the basin.
- The GSP includes a map of water wells in the basin (Figure 2-6). However, the map groups all wells together and does not differentiate between well types such as domestic, irrigation, or industrial wells. Additionally, the plan fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the basin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Map the location of DACs and provide the name and population of each identified DAC. The DWR DAC mapping tool can be used for this purpose.[2] Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

[2] The DWR DAC mapping tool is available online at: https://gis.water.ca.gov/app/dacs/.

- Include a domestic well density map for the basin.
- Include a map showing domestic well locations and average well depth across the basin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis.

The GSP states (p. 3-49): *"Initial mapping of interconnected surface water in the Basin was informed by conditions simulated using the hydrologic model developed by the USGS (further described in Section 3.3). The model was used to evaluate stream reaches that are simulated to be more interconnected to shallow groundwater. Results of this analysis indicate that much of the mainstem of the Petaluma River, along with much of Tolay Creek and the lower reaches of Lichau, Lynch, Washington, Adobe, Ellis, and Capri creeks are likely interconnected surface waters."* However, no map of stream reaches in the basin is provided.

Section 3.3 (Water Budget) does present values of stream leakage to groundwater as estimated by the Petaluma Valley Integrated Groundwater Flow Model (PVIHM), although does not present further information on the groundwater model. This section says that more information on the model is presented in Appendix 3-A. However, Appendix 3-A is entitled 'Water Year Type Classification for Petaluma Valley, Santa Rosa Plain, and Sonoma Valley'. The actual appendix that describes the PVIHM appears to be missing from the Draft GSP.

RECOMMENDATIONS

- Include the missing appendix that describes the PVIHM. Ensure that the appendix describes data incorporated into the model, including spatial location of monitoring wells and screening depths, stream gauge data, and description of the temporal (seasonal and interannual) variability of the data used to calibrate the model.
- Provide a map showing all the stream reaches in the basin, with reaches clearly labeled as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.
- Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to confirm and illustrate results of the groundwater modeling. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.
- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.

- Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **incomplete**. The GSP maps GDEs using the Sonoma County Veg Map, which we agree is the best available data for the basin. To identify where the potential GDEs are likely to have connection with groundwater, the rooting depths of common tree species were compared to available depth-to-groundwater data. The GSP states (p. 3-51): *"The depth to groundwater mapping utilized available contoured springtime datasets for the shallow aquifer system (from 2015 and 2016) and high-resolution LiDAR data. To address GDE Work Group member concerns that groundwater levels were generally at lower levels in 2015 and 2016 due to dry conditions, minor adjustments in some areas were made to incorporate the shallowest depth to water on record for each well based on a review of all available data from 2005 to 2020."* However, no further details on the available data from 2005 to 2020 was provided.

The GSP states (p. 3-51): *"Following guidance from TNC, potential vegetation GDEs were mapped for areas with depth to groundwater of 30 feet or less to incorporate the potential rooting depths of oak trees (TNC 2018)."* If Valley Oaks exist in the basin, we recommend instead that an 80-foot depth-to-groundwater threshold be used when inferring whether Valley Oak polygons in the Veg Map derived potential GDE map are likely reliant on groundwater. This recommendation is based on a recent correction in TNC's rooting depth database,[3] after finding a typo in the max rooting depth units for Valley Oak. This resulted in a specific change in the max rooting depth of Valley Oak from 24 feet to 24 meters (80 feet). For all other phreatophytes, we continue to recommend that a 30-foot depth-to-groundwater threshold be used when inferring whether all other vegetation polygons are likely reliant on groundwater.

RECOMMENDATIONS

- Discuss available shallow groundwater data. Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around Veg Map derived potential GDE polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the Veg Map derived potential GDE map are supported by groundwater in an aquifer.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as Valley Oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used if these species are present in the basin. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether Valley Oak polygons are connected to groundwater.

[3] TNC. 2021. Plant Rooting Depth Database. Available at: https://groundwaterresourcehub.org/sgma-tools/gde-rooting-depths-database-for-gdes/

- Further discuss data gaps for GDEs, including specific plans and locations for additional shallow monitoring wells.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[4,5] The integration of native vegetation into the water budget is **insufficient**. The water budget includes a separate item for evapotranspiration, but combines crop, native vegetation, and riparian evapotranspiration into one term. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATION

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.
- State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Community Engagement Plan (Appendix 1-E).[6]

The GSP states that the GSA Advisory Committee includes representatives from the environmental stakeholder community, and that the Advisory Committee will continue to meet during GSP implementation. However, we note the following deficiencies with the overall stakeholder engagement process:

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[4] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[5] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[6] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- The GSP documents opportunities for public involvement and engagement through monthly informational emails, the GSA website, public forums, presentations to stakeholder groups within the basin, a rural community engagement program, and GSA Board, Advisory Committee and community meetings. There is no explicit identification of a DAC representative on the Advisory Committee or other outreach targeted to DACs and drinking water users.

- Other than representation on the Advisory Committee, outreach to environmental stakeholders is described in general terms. The role that the Advisory Committee plays during the GSP *implementation* process is unclear.

RECOMMENDATIONS

- In the Community Engagement Plan, describe active and targeted outreach to engage DACs and domestic well owners throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Provide more information on the role of the Advisory Committee during the GSP implementation process.

- Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the basin within the GSP.[7]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[8,9,10]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP presents a well impact study to consider the potential impacts on existing well users (p. 4-14). The well impact study is not clearly presented, but appears to group all wells together (i.e., domestic wells, irrigation wells, public supply wells, and industrial wells), use the 95th percentile shallowest supply well total depth, then add a 'drought factor' as follows (p. 4-14): *"For wells with 10 or more years of historical data, the largest*

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[7] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[8] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[9] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[10] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

consecutive 4-year decline during historical dry periods was used; For wells with less than 10 years of historical data, the future simulated largest consecutive 4-year decline was used." The minimum thresholds are then set as follows (p. 4-19): *"MTs for the chronic lowering of groundwater levels are set at the more protective of historical low conditions with allowances for future droughts and the depths at which existing wells could be impacted by lowering of groundwater levels."*

Despite this analysis, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold, and whether the undesirable results are consistent with the Human Right to Water policy.[11] In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs when defining undesirable results, nor does it describe how the groundwater level minimum thresholds are consistent with Human Right to Water policy and will avoid significant and unreasonable impacts on DACs.

The GSP identifies arsenic, nitrate, and salinity (measured as total dissolved solids, TDS) as constituents of concern (COCs) for the basin. Minimum thresholds are based on a number of supply wells that exceed concentrations of constituents determined to be of concern for the basin. The concentrations are set at the maximum contaminant level (MCL) for arsenic and nitrate and the secondary MCL for TDS. The GSP states (p. 4-36): *"There are other point source contaminants found sporadically in the Basin, but these are not regional in extent, are monitored through various other regulatory programs, and consequently SMC are not established in the GSP. New or additional water quality constituents may be identified as potential COCs applicable to the GSP implementation activities through routine consultation and information sharing with other regulatory agencies. The GSA would then consider adding potential COCs and assigning SMC during the 5-year GSP updates."* However, SMC should be established for all COCs in the basin impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

The GSP only includes a very general discussion of impacts to drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs and drinking water users.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and drinking water users when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

Degraded Water Quality

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality. For specific guidance on how to

[11] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[12]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users.

- Set minimum thresholds and measurable objectives for all water quality constituents within the basin that are impacted by groundwater use and/or management. Ensure they align with drinking water standards.[13]

Groundwater Dependent Ecosystems and Interconnected Surface Waters

For chronic lowering of groundwater levels, when describing effects on beneficial uses and users (Section 4.5.2.4) the GSP states (p. 4-19): *"Maintaining groundwater near or above historical levels will maintain the connected nature of groundwater and surface water in the Basin. This will protect GDE habitat and generally benefit environmental land uses and users."* No analysis or discussion is provided in the GSP that describes impacts on GDEs or establishes SMC for GDEs that are directly dependent on groundwater. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise these environmental beneficial users. Since GDEs are present in the basin, they must be considered when developing SMC for chronic lowering of groundwater levels.

For depletion of interconnected surface water, Appendix 4-B (Development of Sustainable Management Criteria of Interconnected Surface Water) describes the methodology for establishing SMC. This appendix states (p. 1): *"The current methodology sets SMC values using groundwater level proxies by evaluating the groundwater level position relative to observed streambed and stream stage elevations at RMP locations (Figs. 4–6). As outlined in Section 3, the approach will be modified to incorporate future modeling results and groundwater level data."* To describe impacts on beneficial users of ISW, the GSP states (p. 4-56): *"If depletions of interconnected surface water were to reach undesirable results, adverse effects could include the reduced ability of the streamflows to meet instream flow requirements for local fisheries and critical habitat in the Basin. Reduced surface flows can also negatively affect permitted surface water diversions. Consideration of these factors was included as part of SMC development."* However, no analysis or discussion is presented to describe how the SMC will affect beneficial users, and more specifically GDEs, or the impact of these minimum thresholds on GDEs in the basin. Furthermore, the GSP makes no attempt to evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the basin (e.g., steelhead; see Attachment C for a list of environmental users in the basin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

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[12] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[13] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the basin.[14] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[15]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the basin are reached.[16] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,17]

- When establishing SMC for the basin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[18] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more

[14] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[15] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[16] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]
[17] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf
[18] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

on groundwater during times of drought.[19] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using RCP 8.5 and the HadGEM2-ES Global Climate Model. However, the GSP does not consider other extreme climate scenarios in the projected water budget. We encourage you to consider other GCM projections. While HadGEM2-ES may better represent median conditions, other models may better capture other statistics relevant for your basin and may reveal valuable information to account for uncertainty. In addition, the GSP should clearly and transparently incorporate extremely wet and dry scenarios or select more appropriate extreme scenarios for their basin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

The GSP incorporates climate change into key inputs (e.g., precipitation, evapotranspiration, and sea level rise) of the projected water budget. However, imported water should also be adjusted for climate change and incorporated into the surface water flow inputs of the projected water budget. The sustainable yield is calculated based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of extreme climate scenarios and the omission of projected climate change effects on imported water flow inputs, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Consider other GCM projections to account for uncertainty beyond median statistics.
- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change into surface water flow inputs, including imported water, for the projected water budget.
- Incorporate climate change scenarios into projects and management actions.

[19] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around domestic wells in the basin.

Figure 5-4 (Representative Monitoring Point Network for Chronic Lowering of Groundwater Levels) shows insufficient representation of drinking water users for groundwater elevation monitoring. Figure 5-5 (Representative Monitoring Point Network for Degraded Water Quality) shows insufficient representation of drinking water users for water quality monitoring. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[20]

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations (specifying whether they are shallow or deep wells) with the locations of DACs, domestic wells, GDEs, and ISWs to clearly identify monitored areas.
- Increase the number of RMPs in the shallow aquifer across the basin as needed to adequately monitor all groundwater condition indicators across the basin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, and GDEs when identifying new RMPs.
- Ensure groundwater elevation and water quality RMPs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

The management actions described in Section 6.4.1 (Assessment of Potential Policy Options for GSA Consideration) and Section 6.4.2.1 (Coordination of Farm Plans with GSP Implementation) describe improvement to water quality through sediment runoff mitigation and water quality sampling. The GSP specifically describes projects with benefits to GDEs, including the Stormwater Capture and Recharge Project described in Section 6.2.4. However, the plan fails to identify or describe projects or management action with explicit benefits to DACs or drinking water users, including a domestic well mitigation program.

[20] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document".[21]

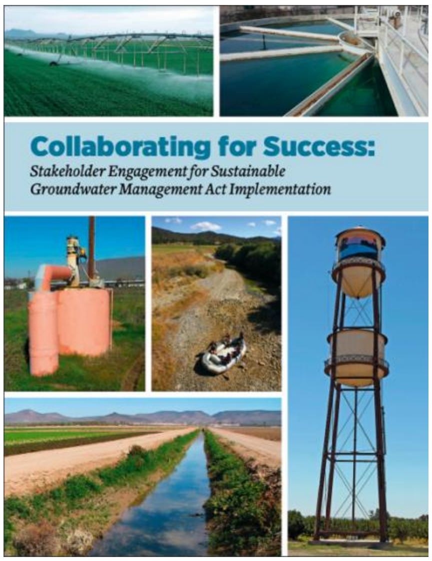
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[21] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

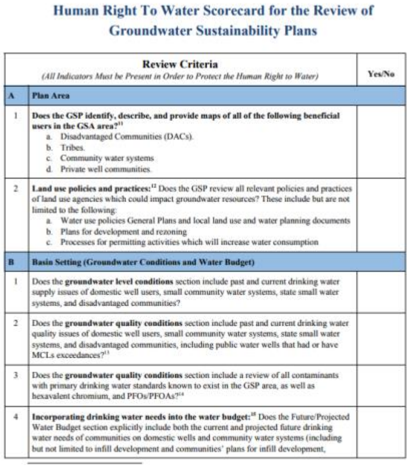
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

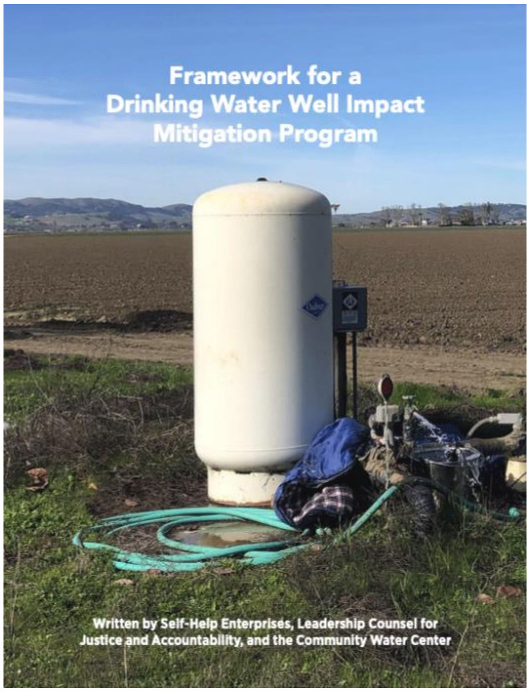


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

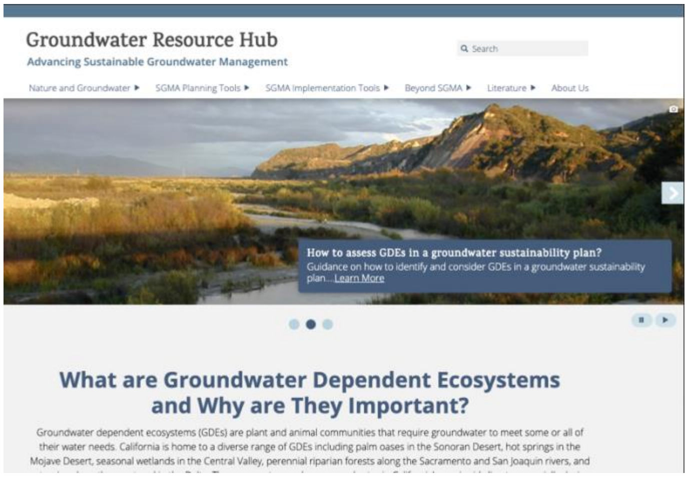
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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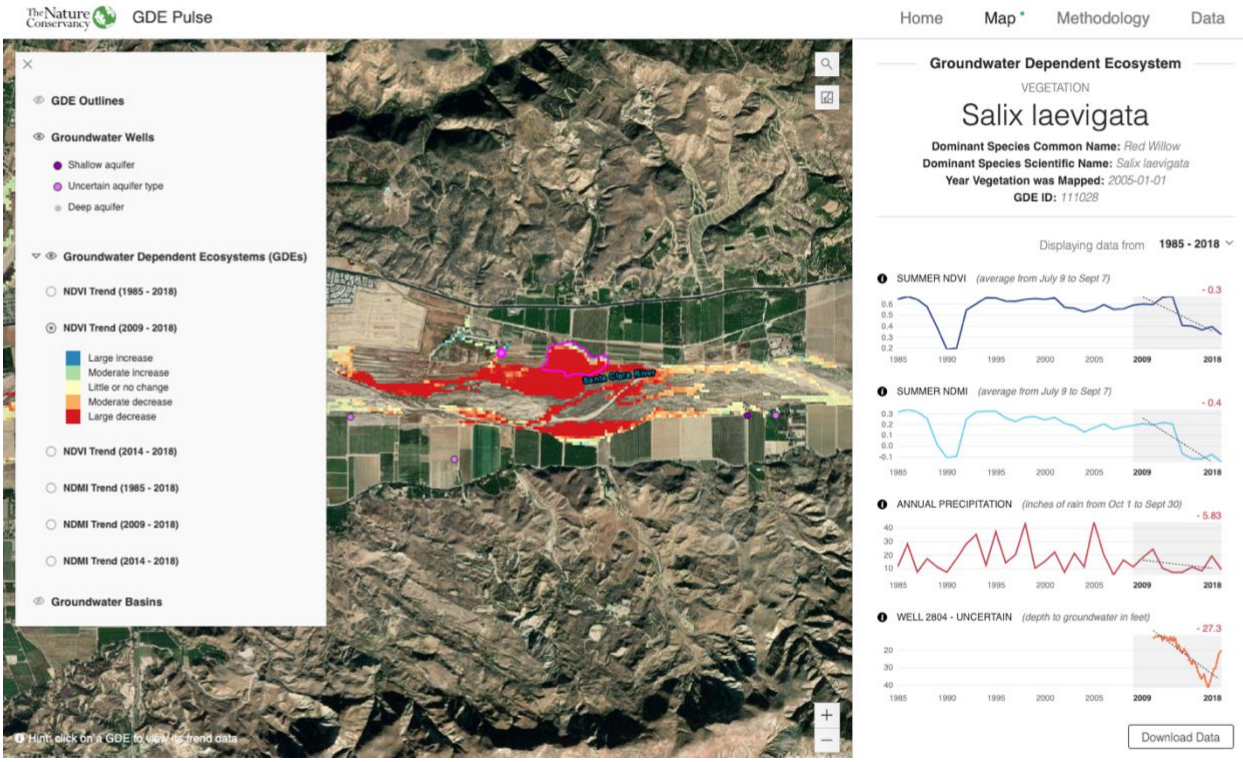
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

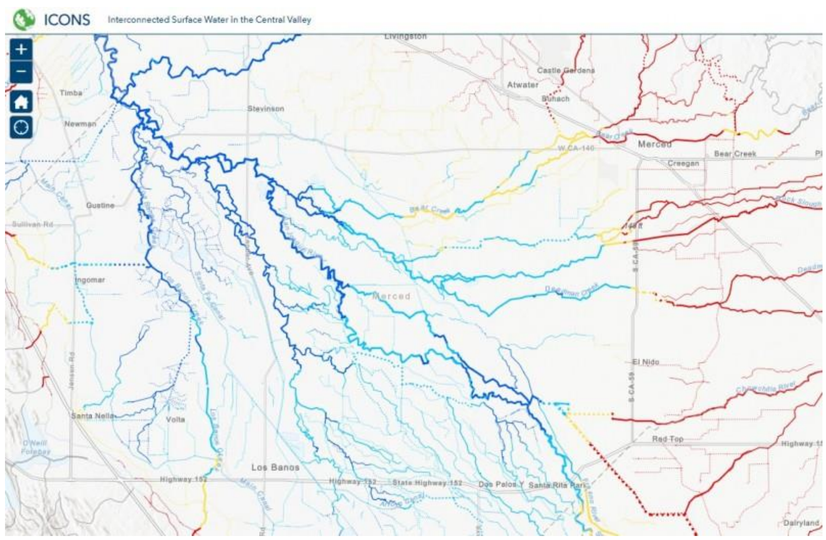
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Petaluma Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Petaluma Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Geothlypis trichas sinuosa	Saltmarsh Common Yellowthroat	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Laterallus jamaicensis coturniculus	California Black Rail	Bird of Conservation Concern	Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Geothlypis trichas trichas	Common Yellowthroat			
Himantopus mexicanus	Black-necked Stilt			
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			

Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Rynchops niger	Black Skimmer			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Crangonyx spp.	Crangonyx spp.			
Cyprididae fam.	Cyprididae fam.			
Hyalella spp.	Hyalella spp.			
Palaemon macrodactylus				Not on any status lists
FISH				
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013

Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Pogonichthys macrolepidotus	Sacramento splittail		Special Concern	Vulnerable - Moyle 2013
Spirinchus thaleichthys	Longfin smelt	Candidate	Threatened	Vulnerable - Moyle 2013
Oncorhynchus mykiss - CCC winter	Central California coast winter steelhead	Threatened	Special	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense "Sonoma"	Sonoma Tiger Salamander	Endangered		Not on any status lists
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Dicamptodon ensatus	California Giant Salamander			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Thamnophis sirtalis sirtalis	Common Gartersnake			
Pseudacris regilla	Northern Pacific Chorus Frog			
Taricha rivularis	Red-bellied Newt			ARSSC
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Aeshna umbrosa occidentalis	Shadow Darner			
Agabus spp.	Agabus spp.			
Agapetus spp.	Agapetus spp.			
Ameletus spp.	Ameletus spp.			
Amiocentrus aspilus	A Caddisfly			

Anax junius	Common Green Darner			
Argia spp.	Argia spp.			
Baetis spp.	Baetis spp.			
Calineuria californica	Western Stone			
Centroptilum spp.	Centroptilum spp.			
Chironomidae fam.	Chironomidae fam.			
Chloroperlidae fam.	Chloroperlidae fam.			
Cinygmula spp.	Cinygmula spp.			
Corixidae fam.	Corixidae fam.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Drunella spp.	Drunella spp.			
Dytiscidae fam.	Dytiscidae fam.			
Enallagma carunculatum	Tule Bluet			
Epeorus spp.	Epeorus spp.			
Ephemerella spp.	Ephemerella spp.			
Ephydridae fam.	Ephydridae fam.			
Eubrianax edwardsii				Not on any status lists
Fallceon quilleri	A Mayfly			
Heptageniidae fam.	Heptageniidae fam.			
Hydrophilidae fam.	Hydrophilidae fam.			
Hydropsyche spp.	Hydropsyche spp.			
Ironodes spp.	Ironodes spp.			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Isoperla spp.	Isoperla spp.			
Laccobius spp.	Laccobius spp.			
Lepidostoma spp.	Lepidostoma spp.			
Lestes disjunctus	Northern Spreadwing			
Malenka spp.	Malenka spp.			
Nereididae fam.	Nereididae fam.			
Optioservus spp.	Optioservus spp.			
Paraleptophlebia spp.	Paraleptophlebia spp.			

Psychodidae fam.	Psychodidae fam.			
Rhionaeschna multicolor	Blue-eyed Darner			
Rhyacophila spp.	Rhyacophila spp.			
Sanfilippodytes spp.	Sanfilippodytes spp.			
Serratella spp.	Serratella spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Suwallia spp.	Suwallia spp.			
Sympetrum corruptum	Variegated Meadowhawk			
Tricorythodes spp.	Tricorythodes spp.			
Wormaldia spp.	Wormaldia spp.			
MAMMALS				
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Assiminea californica				Not on any status lists
Helisoma spp.	Helisoma spp.			
Juga nigrina	Black Juga			
Lymnaea spp.	Lymnaea spp.			
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Sphaeriidae fam.	Sphaeriidae fam.			
Sphaerium spp.	Sphaerium spp.			
PLANTS				
Arundo donax	NA			
Blennosperma bakeri	Baker's Blennosperma	Endangered	Endangered	CRPR - 1B.1
Callitriche trochlearis	Waste-water Water-starwort			
Cotula coronopifolia	NA			
Damasonium californicum				Not on any status lists
Eleocharis macrostachya	Creeping Spikerush			

Eryngium aristulatum aristulatum	California Eryngo			
Glyceria leptostachya	Slim-head Mannagrass			
Helenium puberulum	Rosilla			
Jaumea carnosa	Fleshy Jaumea			
Juncus phaeocephalus phaeocephalus	Brown-head Rush			
Lepidium oxycarpum	Sharp-pod Pepper-grass			
Mimulus guttatus	Common Large Monkeyflower			
Perideridia kelloggii	Kellogg's Yampah			
Phacelia distans	NA			
Phragmites australis australis	Common Reed			
Pleuropogon californicus californicus				Not on any status lists
Psilocarphus oregonus	Oregon Woolly-heads			
Rumex conglomeratus	NA			
Ruppia maritima	Ditch-grass			
Salix lasiolepis lasiolepis	Arroyo Willow			
Sidalcea calycosa rhizomata	Point Reyes Checkerbloom		Special	CRPR - 1B.2
Spartina foliosa	California Cordgrass			
Stachys ajugoides	Bugle Hedge-nettle			
Symphyotrichum lentum	Suisun Marsh Aster		Special	CRPR - 1B.2
Typha latifolia	Broadleaf Cattail			
Zannichellia palustris	Horned Pondweed			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

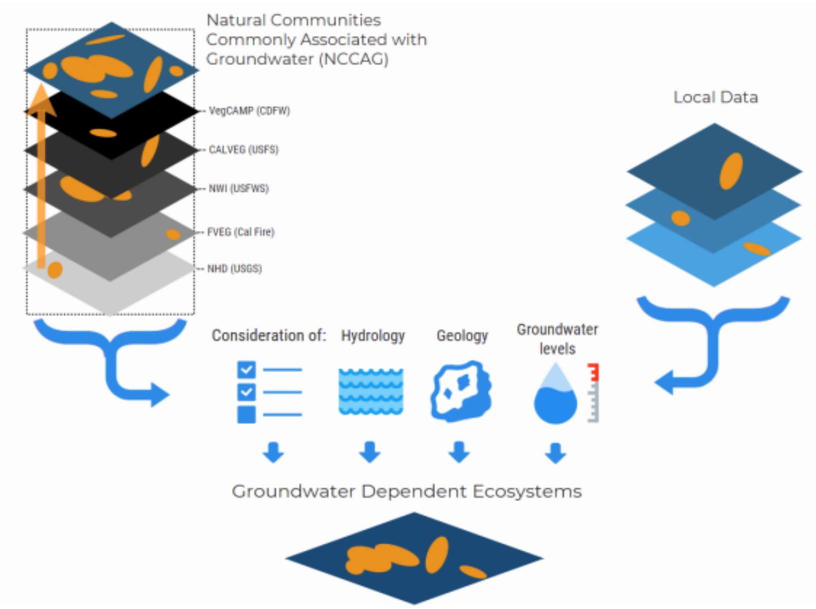


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

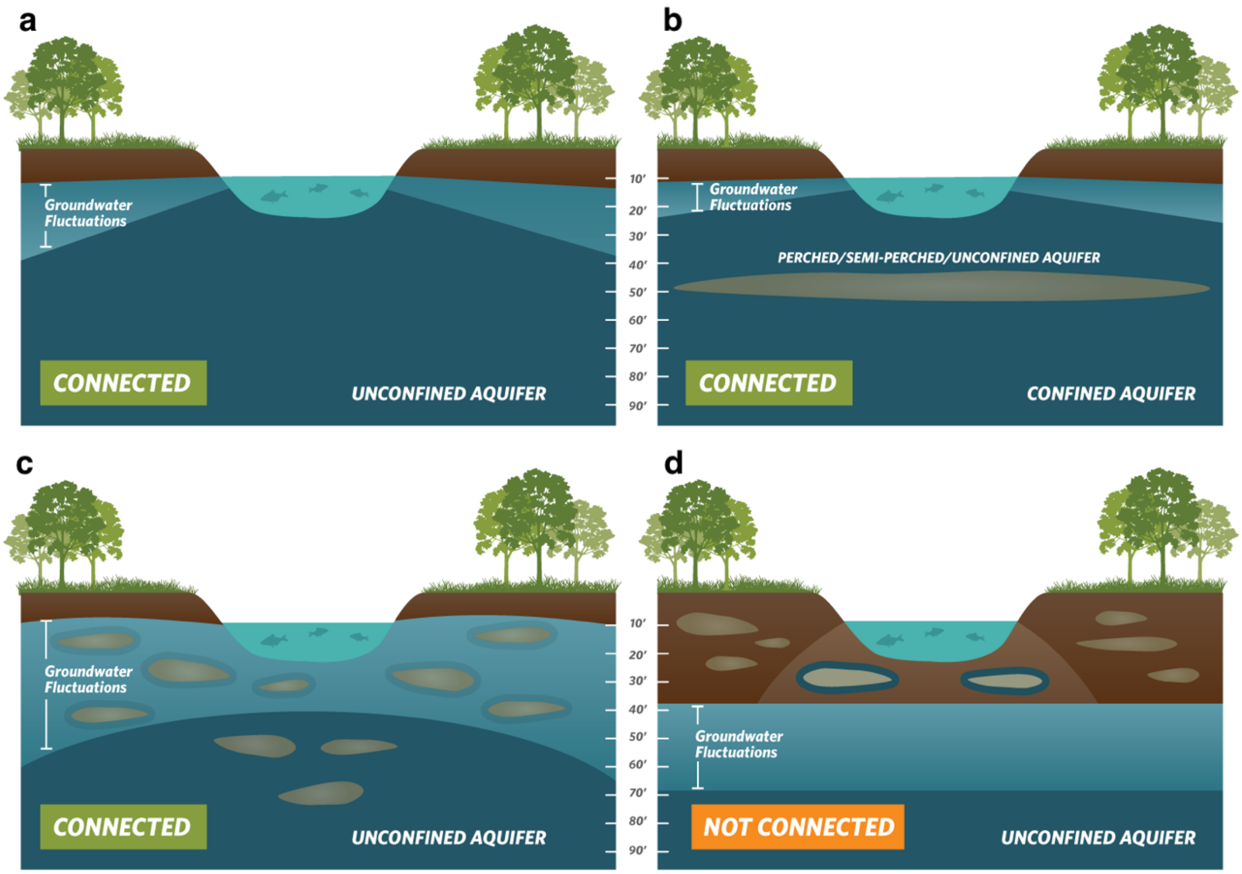

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

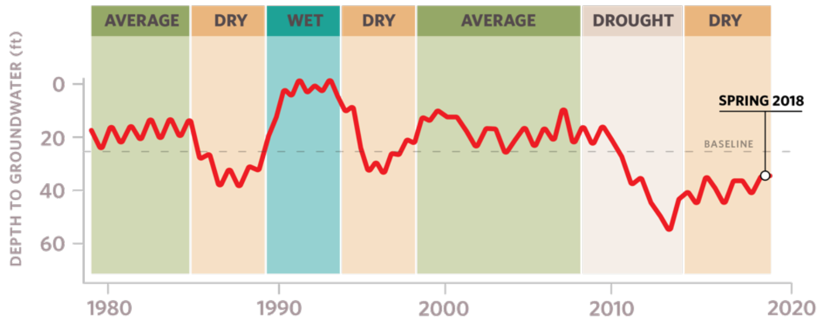

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

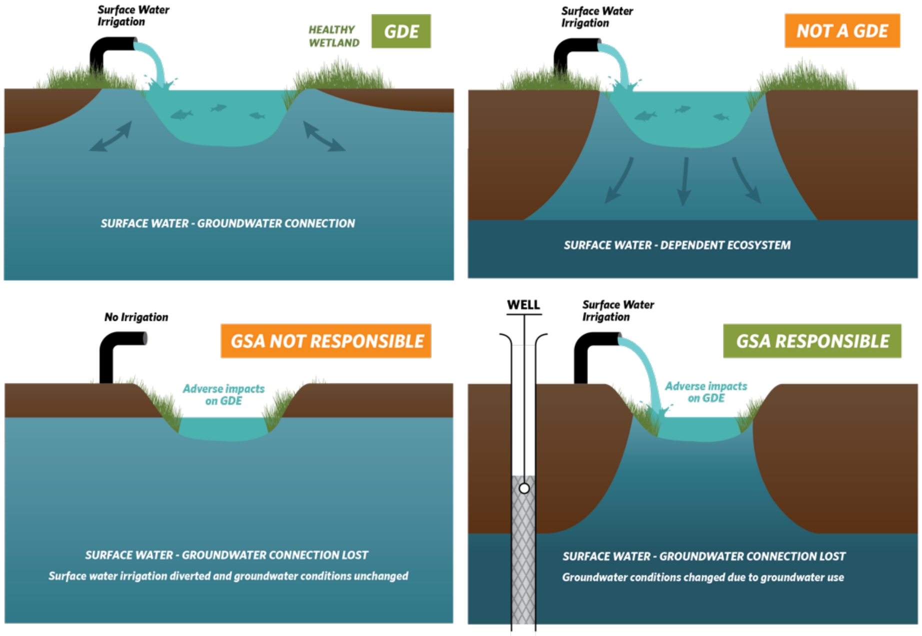

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

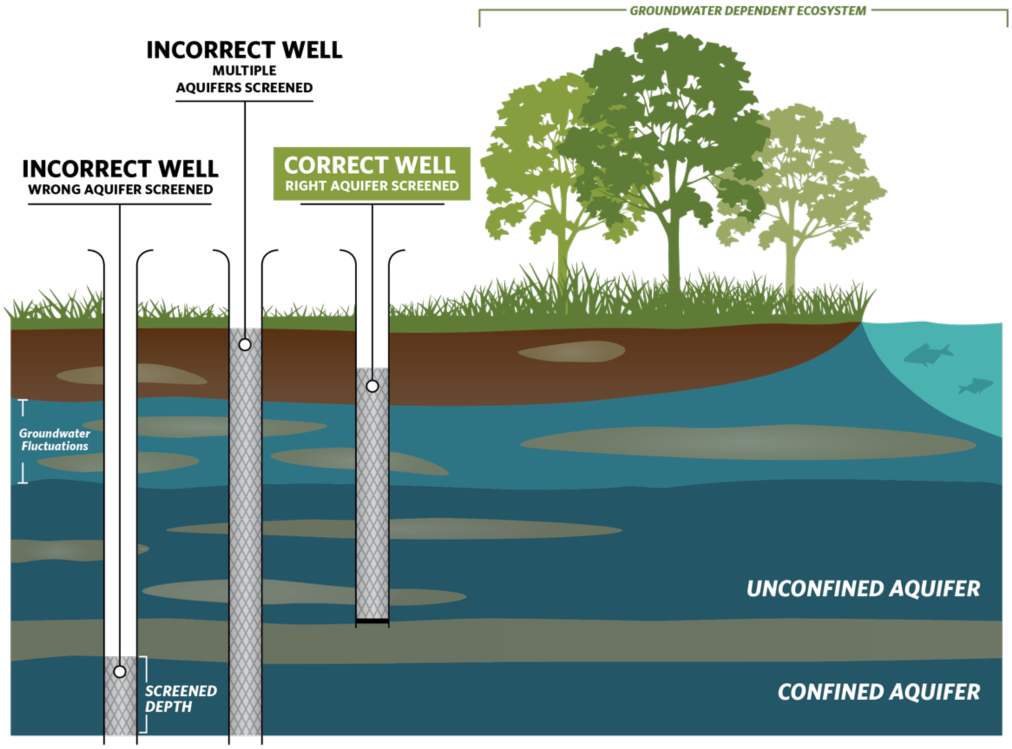

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

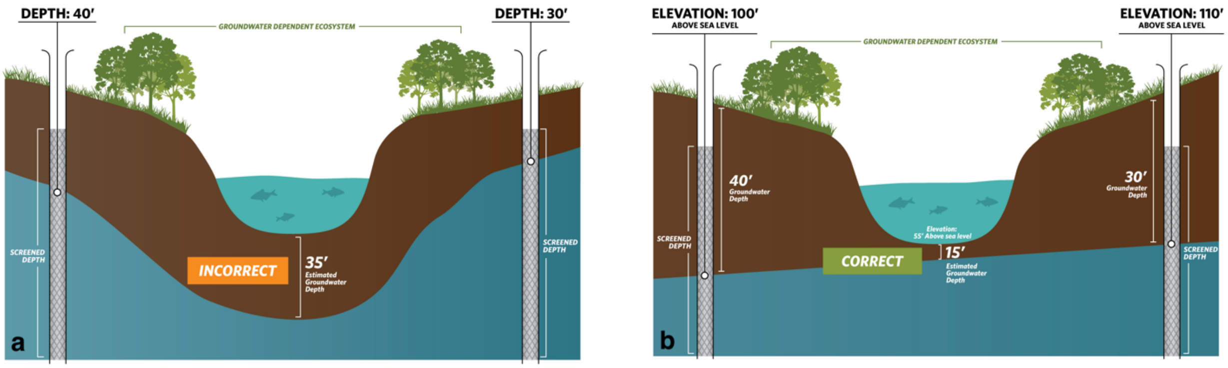

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

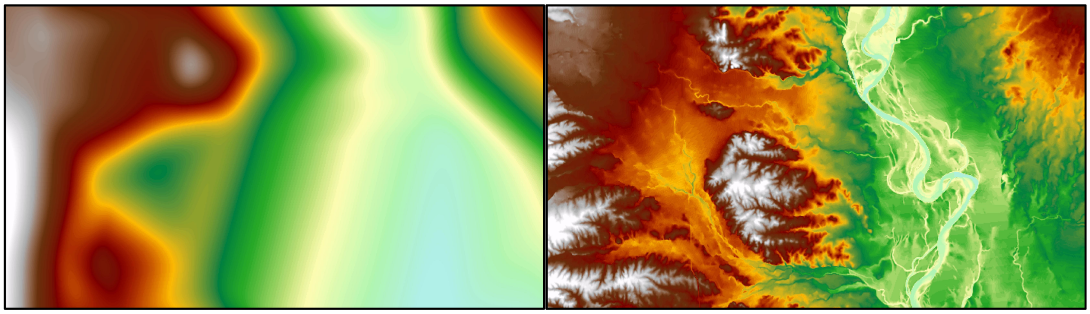

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

October 20, 2021

Fillmore and Piru Basins Groundwater Sustainability Agency
PO Box 1110
Fillmore, CA 93016

Submitted via email: evai@unitedwater.org

Re: Public Comment Letter for Piru Basin Draft GSP

Dear Eva Ibarra,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Piru Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Piru Basin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Piru Basin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP provides information on DACs, including identification by name and location on a map (Figure 2.1-4). However, the GSP fails to clearly state the population of each DAC or include the population dependent on groundwater as their source of drinking water in the basin.

The GSP provides a density map of domestic wells in the basin. However, the plan fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the basin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide the population of each identified DAC. • Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). • Include a map showing domestic well locations and average well depth across the basin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **insufficient**, due to lack of supporting information provided for the ISW analysis. To assess ISWs, the plan refers to a previous report by United Water Conservation District, included in the GSP as Appendix E. This Appendix describes a numerical model developed for a regional area that includes the Piru Basin.

The main text of the GSP presents a summary of annual depletions of ISW in the Piru Basin at one location of the Santa Clara River. The ISW section of the GSP concludes with the statement (p. 2-56): “Data gaps remain regarding identifying the extent and timing of interconnectedness of other stream channel areas (e.g., Piru Creek and central and eastern portions of the Santa Clara River), due to a lack of paired groundwater level and surface water level monitoring sites. Stream conditions are considered to vary between all three stream conditions depicted on Figure 2.2-28, except at the Dell Valle potential GDE unit (Figure 2.2-30), where stream flows are sustained perennially by wastewater effluent from the Santa Clara River Valley East. The significance of interconnected surface water and groundwater conditions at these areas is less than that of the area of rising groundwater, because surface water exists less often in the Piru Creek and central Santa Clara River reaches (Figure 2.2-11) and surface water flows are sustained in Piru Creek by United releases from Lake Piru.” However, no map is provided to show the stream reaches to which this statement refers. Without a map of labeled stream reaches in the basin, it is difficult to understand the location of these reaches, and whether the GSP has included them as potential ISWs in the GSP. In addition, it is unclear whether the GSP is only considering ISWs in areas with “rising groundwater” (gaining conditions). Under SGMA’s ISW definition[1], they must also include losing reaches that maintain a connection with the saturated zone at *any* point in time and space.

RECOMMENDATIONS

- Provide a map showing all the stream reaches in the basin, with reaches clearly labeled with stream name and interconnected (gaining, losing) or disconnected status.

- Provide more discussion in the GSP about the groundwater elevation data and streambed elevation data that could be used to verify the modeling analysis for interconnected reaches. Include a map of the interpolated groundwater elevations and spatial extent of groundwater monitoring wells used to produce the map. Discuss screening depth of monitoring wells and ensure they are monitoring the shallow principal aquifer.

- To confirm the results of the groundwater modeling, overlay the stream reaches shown with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

- On the ISW map, clearly label the areas with data gaps. While the GSP clearly identifies data gaps and their locations in the text, we recommend that the GSP considers any segments with data gaps as potential ISWs and clearly marks them as such on maps provided in the GSP.

[1] “‘Interconnected surface water’ refers to surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted.” [23 CCR §351(o)]

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **incomplete**. We commend the GSA for their efforts to evaluate GDEs in the basin, as presented in the GDE Technical Memorandum (Appendix D). The GSP mapped GDEs and potential GDEs using multiple sources, including the NC Dataset (also referred to in the GSP as the iGDE database), California Department of Fish and Wildlife (CDFW) VegCAMP, US Department of Agriculture (USDA) CalVeg, and National Wetlands Inventory data. However, we would also like to see aquatic GDEs (e.g., steelhead critical habitat) mapped. Table 2.2-5 describes the type of GDEs in the basin with dominant flora species and acreage within the basin. Table 2.2-7 presents the critical habitat and special status species in the basin.

The Appendix states (p. 21): "In light of the limitations of the monitoring well data, the groundwater elevation data presented in this section are intended to illustrate general trends within GDE units. The spring 2019 depth to water surface (Section 2.1.2), as opposed to monitoring well data, is used to establish GDE connectivity with shallow groundwater." The Appendix describes the challenges with using groundwater monitoring well data for some of the GDE units and explains that 2019 groundwater levels are conservative for GDE mapping. However, we would like to see additional discussion and use of groundwater data from the pre-SGMA benchmark date of 2015 where available (e.g., pre-drought 2011 water levels) to determine which GDE units are connected to groundwater.

Furthermore, we found that some mapped features in the NC dataset were improperly disregarded (i.e., coastal live oak (*Quercus agrifolia*) on slopes). NC dataset polygons were incorrectly excluded for mapped vegetation growing on a clear slope, based on landscape position and improbable connection to groundwater. However, without groundwater data, there is no way to confirm that these NC dataset polygons are not GDEs. If no data are available, then these polygons should be retained as potential GDEs.

RECOMMENDATIONS
• For GDE units where groundwater elevation data are available, we recommend the pre-SGMA period of 2005-2015 be used to verify a connection to groundwater. If complete data from this period are not available, consider the use of data from 2011 (a wet year) since it is before the SGMA benchmark date of 2015. • Identify aquatic GDE habitats (e.g., steelhead critical habitat) in the GSP, and specify which reaches support migration, spawning, and rearing. • Re-evaluate the NC dataset polygons that were removed based on their location on a slope. If groundwater elevation data are not available to verify connection to groundwater, retain these polygons as potential GDEs in the GSP.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[2,3] to be included in the water budget. The integration of native vegetation into the water budget is **sufficient**. We commend the GSA for including the groundwater demands of this ecosystem in the historical, current and projected water budgets. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATION
• State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders[4] is not fully met by the description in the Communication and Engagement Plan (Appendix B). We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms. They include attendance at public meetings, a stakeholder email list, updates to the GSP website and social media, and information shared at meetings held by other local agencies and organizations. There is no specific outreach during the GSP development process described for environmental stakeholders and domestic well owners.

- The Communication and Engagement Plan does not include a detailed plan for continual opportunities for engagement through the implementation phase of the GSP that is specifically directed to environmental stakeholders.

RECOMMENDATION

[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- Include a more detailed and robust Communication and Engagement Plan that describes active and targeted outreach to engage DAC members, domestic well owners, and environmental stakeholders during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[5] and establishing minimum thresholds[6,7]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP mentions impacts to DACs and domestic drinking water wells when defining undesirable results. The GSP states (p. 3-3): "Groundwater levels below the base of well perforations (or screen intervals) prevents beneficial uses (i.e., domestic) and users (i.e., DACs) from benefiting from the California Human Right to Water due to dry well conditions." However, the GSP does not sufficiently describe how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results in the basin. The measurable objectives set for groundwater elevations do not consider DACs and drinking water users.

The GSP states (2-41): "Historically water quality chemicals (analytes or constituents) of concern (COCs) in the Fillmore and Piru basins have generally included, but are not necessarily limited to, the following analytes: Total Dissolved Solids (TDS), Sulfate, Chloride, Nitrate, and Boron." The GSP further states (2-50): "Additional potential COCs in the Piru Basin were identified [as] Radiochemistry (gross alpha and uranium), Selenium, Lead, Iron, and Manganese." The GSP states that the minimum thresholds for degraded water quality correspond with water quality objectives (WQOs) and maximum contaminant levels (MCLs) established by the Los Angeles Regional Water Quality Control Board (LARWQCB) Basin Plan and California Division of Drinking Water (DDW), respectively. However, they are not specifically provided in Section 3 (Sustainable Management Criteria) of the GSP.

For degraded water quality, the GSP does not discuss direct and indirect impacts on DACs or drinking water users when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on these

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[5] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[6] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[7] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

stakeholders. The GSP does not set any measurable objectives for the degraded water quality sustainability indicator.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe further the direct and indirect impacts on DACs and drinking water users when defining undesirable results for chronic lowering of groundwater levels.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs and drinking water users within the basin. Further describe the impact of passing the minimum threshold for drinking water users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.

Degraded Water Quality

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users.

- Include the minimum thresholds established for the identified COCs in Section 3 (Sustainable Management Criteria) of the GSP, instead of just stating that they align with drinking water standards.

- Set measurable objectives for the degraded water quality sustainability indicator.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

We commend the GSA for their comprehensive analysis of undesirable results for GDEs and ISWs. The GSP analyzes the impacts on GDEs when defining undesirable results for three sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, and depletions of interconnected surface waters).

For minimum thresholds, the GSP states (p. 3-9): "The MT for groundwater levels in the Cienega Restoration / Fish Hatchery area is set at the critical water level (Kibler, 2021 and Kibler et al., 2021), 10 ft below 2011 low groundwater levels (i.e., the MO). If/when this MT is exceeded, mitigation (Section 4) will be implemented to offset the undesirable result that would occur without adequate soil moisture." The GSP does not, however, assess the impacts of minimum thresholds on the other GDEs in the basin.

The GSP notes that the Cienega Riparian Complex has historically shown the greatest degradation due to groundwater levels (p. 2-78). It also describes this impact as an undesirable result due to groundwater levels declining, resulting in (p. 3-4) "die off of riparian vegetation (e.g., cottonwood or willow species in the Cienega Riparian Complex GDE unit), due to groundwater level declines below the critical water level, that are attributable to groundwater pumping." If the minimum threshold is exceeded, the referenced mitigation action will require months or years to implement. However, there is no discussion of interim pumping reductions or other actions that could have an immediate positive impact on the undesirable result.

RECOMMENDATIONS

- Provide explicit discussion of how the minimum threshold (10 feet below 2011 groundwater levels) will prevent undesirable results specifically for **all** GDEs in the basin, not just those in the Cienega Restoration / Fish Hatchery area.
- State directly what the depth to groundwater corresponds to under the GDEs for the proposed minimum threshold (10 feet below 2011 groundwater levels), and how it compares to plant rooting depth information.
- Consider GDEs when establishing measurable objectives and evaluate the measurable objectives based on GDE water needs.

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[8] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures. The effects of climate change can intensify the impacts of water stress on GDEs, making available shallow groundwater resources more critical for their survival. Research shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought[9]. When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2070. However, the GSP does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

The GSP includes climate change into key inputs (e.g., precipitation, evapotranspiration, surface water flow, and sea level) of the projected water budget. However, imported water is not included in the projected water budget or stated to be adjusted for climate change. The GSP calculates a sustainable yield based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios and projected climate change effects on imported water volumes, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

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[8] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]
[9] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

RECOMMENDATIONS
• Integrate climate change, including extreme wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions. • Incorporate imported water inputs that are adjusted for climate change to the projected water budget. • Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs and domestic wells in the basin.

Figure 2.1-8 (Existing Groundwater Elevation Monitoring Programs Map) and Figure 2.1-9 (Existing Groundwater Quality Monitoring Programs Map) show that no monitoring wells are located across portions of the basin near DACs and domestic wells (see maps provided in Attachment E). Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[10].

The GSP provides comprehensive discussion of data gaps for GDEs and ISWs. Section 3.5.4.4.2 (Potential New Monitor Wells) discusses plans to include installation of new shallow monitoring wells to provide water level data around GDEs and ISWs, which is further described in Appendix D (Assessment of Groundwater Dependent Ecosystems for the Fillmore and Piru Basins Groundwater Sustainability Agency) and Appendix K (Monitoring Network and Data Gaps). However, this information is scattered across several locations in the GSP without a comprehensive set of maps provided.

RECOMMENDATIONS
• Provide maps that overlay monitoring well locations with the locations of DACs and domestic wells to clearly identify potentially impacted areas. Increase the number of representative monitoring points (RMPs) in the shallow aquifer across the basin for the groundwater elevation and water quality groundwater condition indicators. Prioritize proximity to DACs and drinking water users when identifying new RMPs. • Provide maps that overlay existing and proposed monitoring well locations with the locations of GDEs and ISWs to clearly identify potentially impacted areas. • Describe further the biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the basin. Appendix D discusses remote sensing of GDEs using NDVI or other data to monitor the health of GDEs through time, but few details are provided.

[10] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

- Provide discussion that adaptive changes in SMC for GDEs will be made, if GDE groundwater or biological monitoring reveals that existing SMC are not protective of these ecosystems.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to beneficial users of groundwater such as DACs and drinking water users.

We commend the GSA for including several projects and management actions with explicit benefits to the environment. However, the GSP does not discuss the manner in which DACs and drinking water users may be benefitted or impacted by projects and management actions identified in the GSP. Potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

The plan's commitment to mitigate the undesirable result on the Cienega Riparian Complex GDE is insufficient. The plan is confusing in that the mitigation refers only to the Cienega Springs Restoration project and does not seem to propose any mitigation for the Cienega Riparian Complex GDE. Furthermore, it is not clear how the proposed Projects 1 & 2 would mitigate impacts to the Cienega Riparian Complex GDE even if it is part of the Cienega Springs Restoration project area.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- For GDEs, include the following: 1) Add a map showing the locations of the Cienega Riparian Complex GDE and the Cienega Springs Restoration project, 2) Explain how the proposed management actions will mitigate the undesirable result occurring at the Cienega Riparian Complex GDE, 3) Develop immediate and longer term management actions to address the undesirable result occurring at the Cienega Riparian Complex (e.g., immediate pumping reductions when the minimum threshold is reached, non-native vegetation removal should die-off occur).

- If the data gathered from additional monitoring in the basin reveals that other GDEs are present, develop mitigation actions for undesirable impacts on those GDEs.

- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to

integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[11].

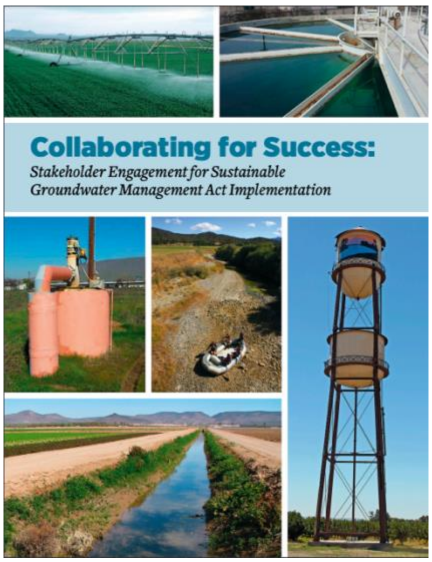
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[11] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



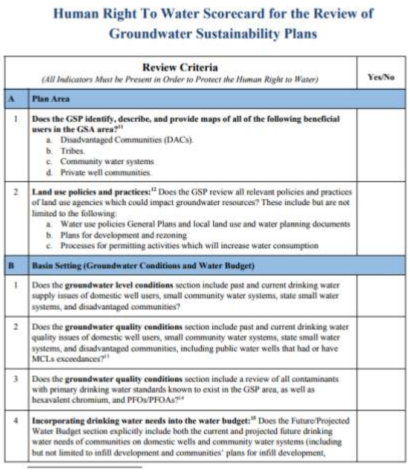
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

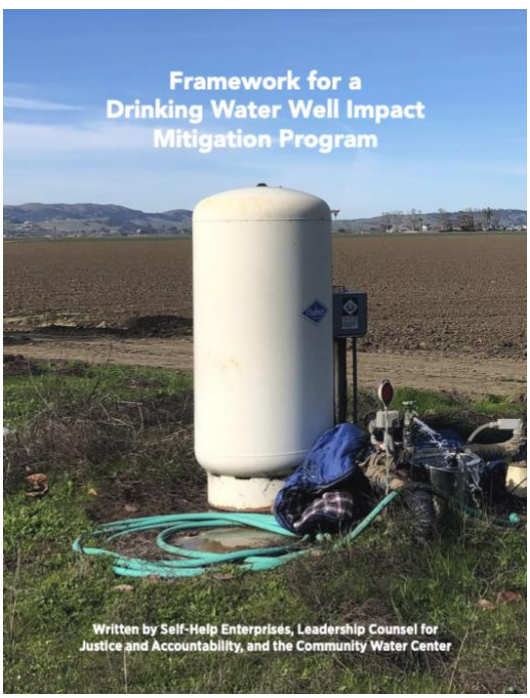


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

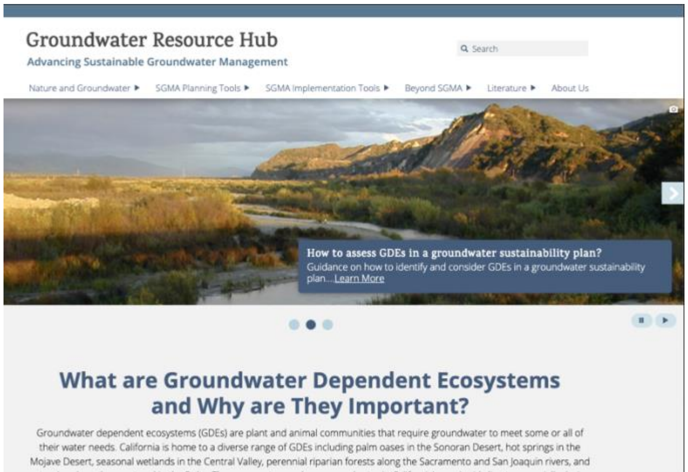
The [Human Right to Water Scorecard] was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



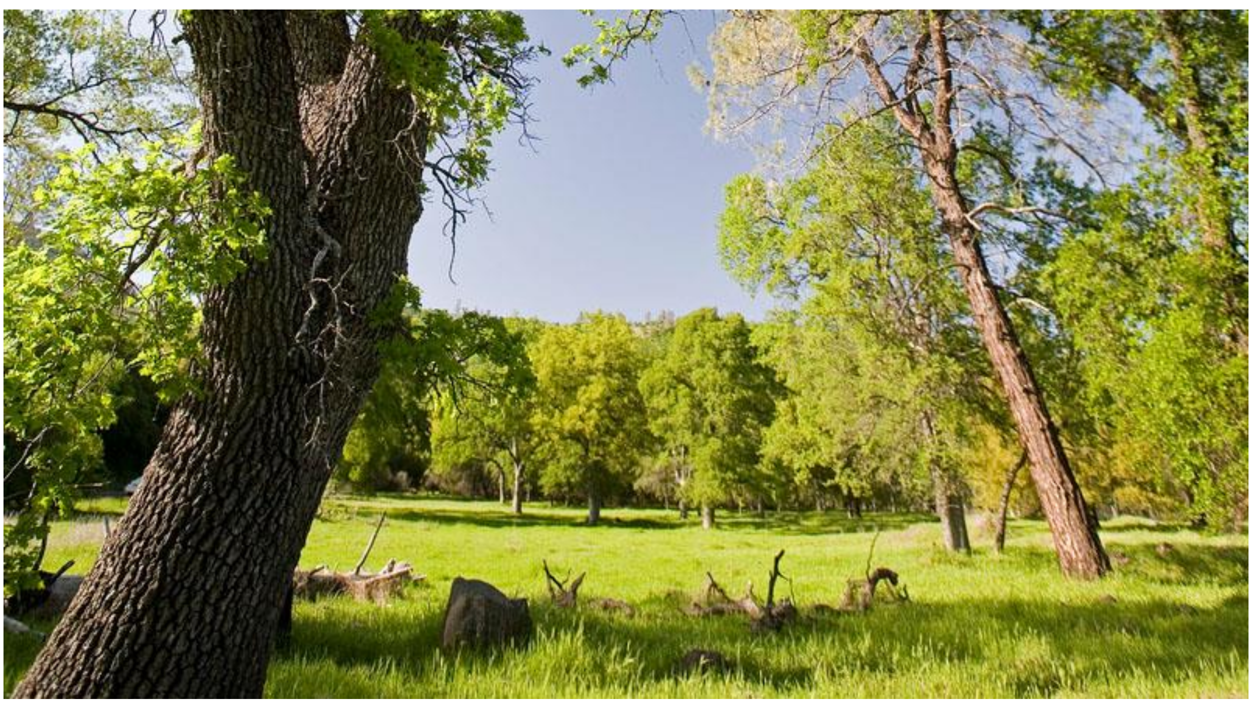
The [Drinking Water Well Impact Mitigation Framework] was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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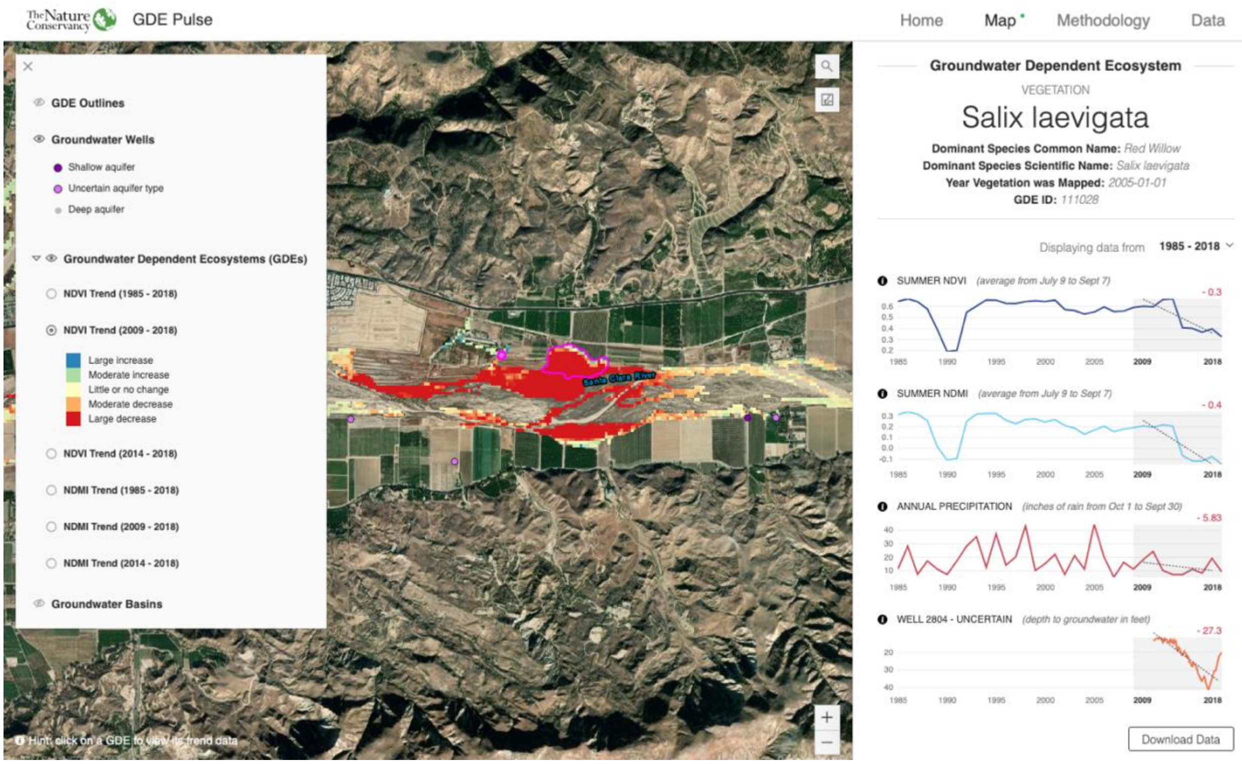
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](https://gde.codefornature.org) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

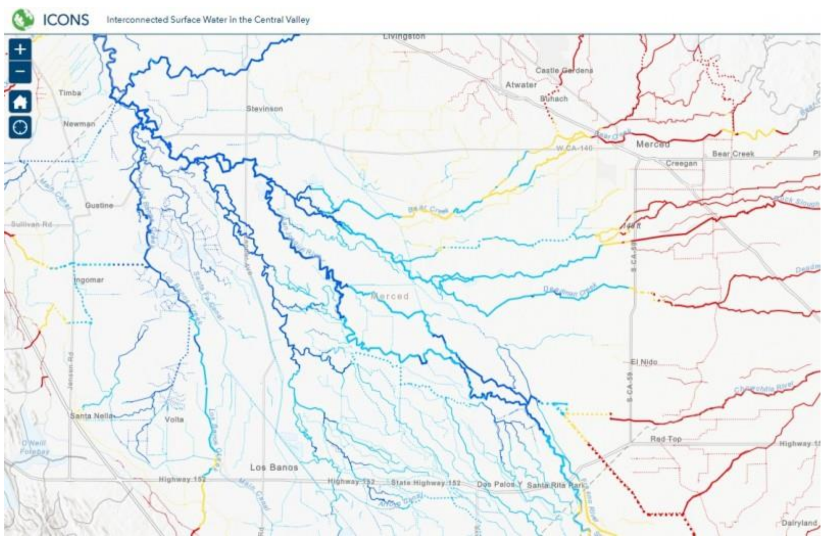
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data [available online](#) from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Piru Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Piru Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Anas platyrhynchos	Mallard			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Cypseloides niger	Black Swift	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Nycticorax nycticorax	Black-crowned Night-Heron			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Vireo bellii	Bell's Vireo			
CRUSTACEANS				

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Americorophium spp.	Americorophium spp.			
Cyprididae fam.	Cyprididae fam.			
Hyalella azteca	An Amphipod			
Hyalella spp.	Hyalella spp.			
FISHES				
Catostomus santaanae	Santa Ana sucker	Threatened	Special Concern	Endangered - Moyle 2013
Gasterosteus aculeatus williamsoni	Unarmored threespine stickleback	Endangered	Endangered	Endangered - Moyle 2013
Oncorhynchus mykiss - Southern CA	Southern California steelhead	Endangered	Special Concern	Endangered - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern	ARSSC
Pseudacris cadaverina	California Treefrog			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Ambrysus californicus				Not on any status lists
Ambrysus spp.	Ambrysus spp.			
Antocha spp.	Antocha spp.			
Apedilum spp.	Apedilum spp.			
Argia agrioides	California Dancer			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetidae fam.	Baetidae fam.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brechmorhoga mendax	Pale-faced Clubskimmer			

Capniidae fam.	Capniidae fam.			
Chironomidae fam.	Chironomidae fam.			
Chironomus anonymus				Not on any status lists
Chironomus spp.	Chironomus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corixidae fam.	Corixidae fam.			
Cricotopus annulator				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus curryi				Not on any status lists
Cryptochironomus spp.	Cryptochironomus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Dytiscidae fam.	Dytiscidae fam.			
Enallagma spp.	Enallagma spp.			
Ephydridae fam.	Ephydridae fam.			
Eukiefferiella claripennis				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Helichus spp.	Helichus spp.			
Helichus striatus				Not on any status lists
Helochares normatus				Not on any status lists
Hetaerina americana	American Rubyspot			
Hydrophilidae fam.	Hydrophilidae fam.			
Hydropsyche alternans				Not on any status lists
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila ajax	A Caddisfly			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Labrundinia maculata				Not on any status lists
Labrundinia spp.	Labrundinia spp.			
Libellula saturata	Flame Skimmer			
Limnophyes spp.	Limnophyes spp.			
Micrasema arizonica				Not on any status lists
Micrasema spp.	Micrasema spp.			
Microcylloepus spp.	Microcylloepus spp.			

Micropsectra spp.	Micropsectra spp.			
Microtendipes spp.	Microtendipes spp.			
Microvelia spp.	Microvelia spp.			
Nanocladius spp.	Nanocladius spp.			
Nectopsyche spp.	Nectopsyche spp.			
Nemouridae fam.	Nemouridae fam.			
Ochrotrichia spp.	Ochrotrichia spp.			
Oecetis spp.	Oecetis spp.			
Optioservus canus	Pinnacles Optioservus Riffle Beetle		Special	
Optioservus spp.	Optioservus spp.			
Orthocladius appersoni				Not on any status lists
Orthocladius spp.	Orthocladius spp.			
Oxyethira aculea				Not on any status lists
Oxyethira spp.	Oxyethira spp.			
Paltothemis lineatipes	Red Rock Skimmer			
Paracladopelma spp.	Paracladopelma spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Peltodytes callosus				Not on any status lists
Peltodytes spp.	Peltodytes spp.			
Pentacora spp.	Pentacora spp.			
Pentaneura inconspicua				Not on any status lists
Pentaneura spp.	Pentaneura spp.			
Petrophila spp.	Petrophila spp.			
Phaenopsectra dyari				Not on any status lists
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum albicorne				Not on any status lists
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Psectrocladius barbimanus				Not on any status lists
Psectrocladius spp.	Psectrocladius spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Pseudosmittia spp.	Pseudosmittia spp.			
Psychodidae fam.	Psychodidae fam.			
Rheotanytarsus hamatus				Not on any status lists

Rheotanytarsus spp.	Rheotanytarsus spp.			
Sigara alternata				Not on any status lists
Sigara spp.	Sigara spp.			
Simuliidae fam.	Simuliidae fam.			
Simulium anduzei				Not on any status lists
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sperchon stellata				Not on any status lists
Stictotarsus spp.	Stictotarsus spp.			
Stictotarsus striatellus				Not on any status lists
Sympetrum corruptum	Variegated Meadowhawk			
Sympetrum illotum	Cardinal Meadowhawk			
Tanytarsus angulatus				Not on any status lists
Tanytarsus spp.	Tanytarsus spp.			
Tinodes spp.	Tinodes spp.			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus spp.	Tropisternus spp.			
MOLLUSKS				
Gyraulus spp.	Gyraulus spp.			
Hydrobiidae fam.	Hydrobiidae fam.			
Physa acuta	Pewter Physa			Not on any status lists
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Sphaeriidae fam.	Sphaeriidae fam.			
Sphaerium occidentale				Not on any status lists
Sphaerium spp.	Sphaerium spp.			
PLANTS				
Anemopsis californica	Yerba Mansa			
Cotula coronopifolia	NA			
Salix exigua exigua	Narrowleaf Willow			
Salix laevigata	Polished Willow			
Sinapis alba	NA			
Veronica anagallis-aquatica	NA			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

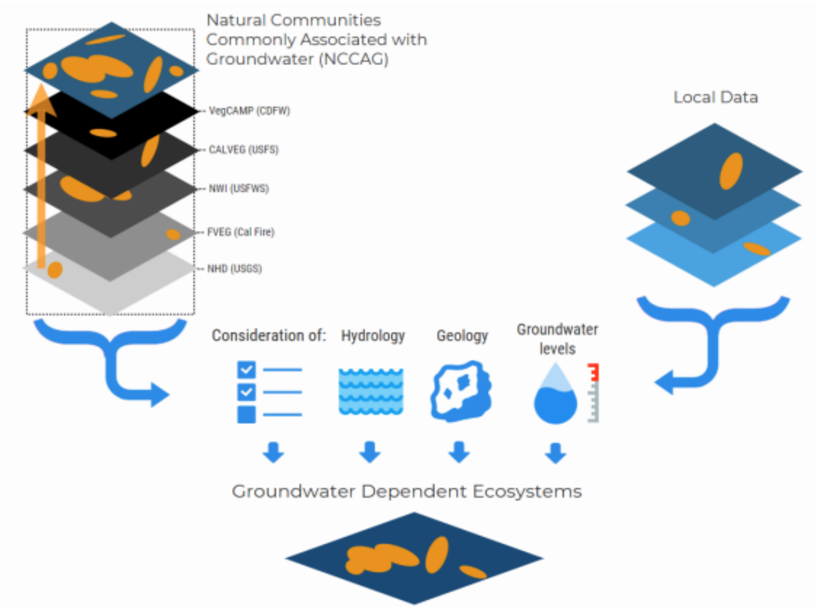


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

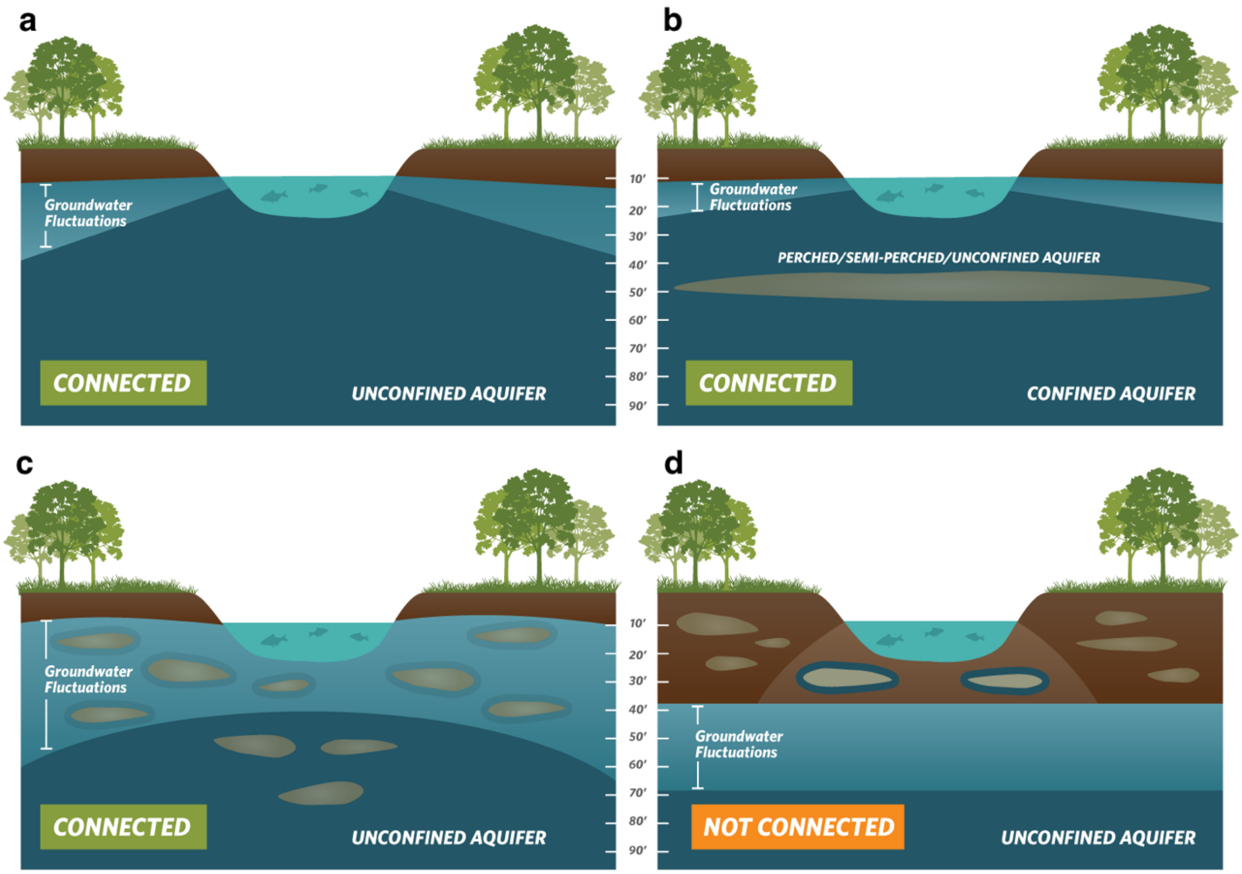

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

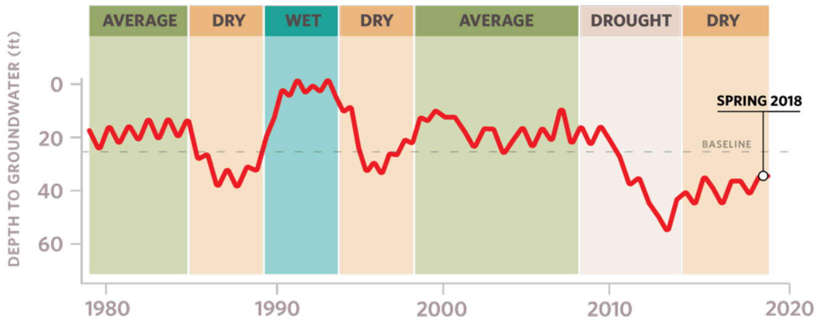

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

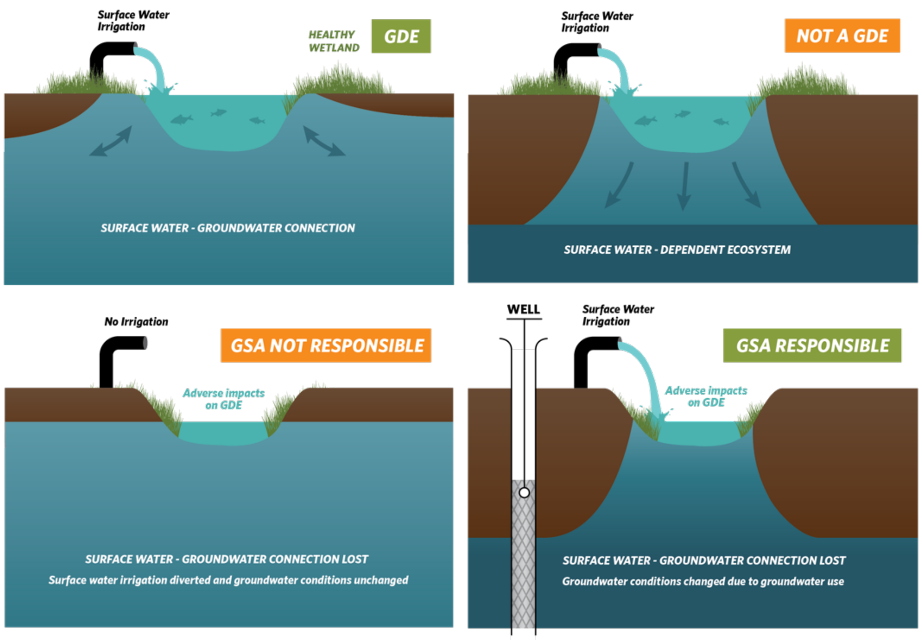

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

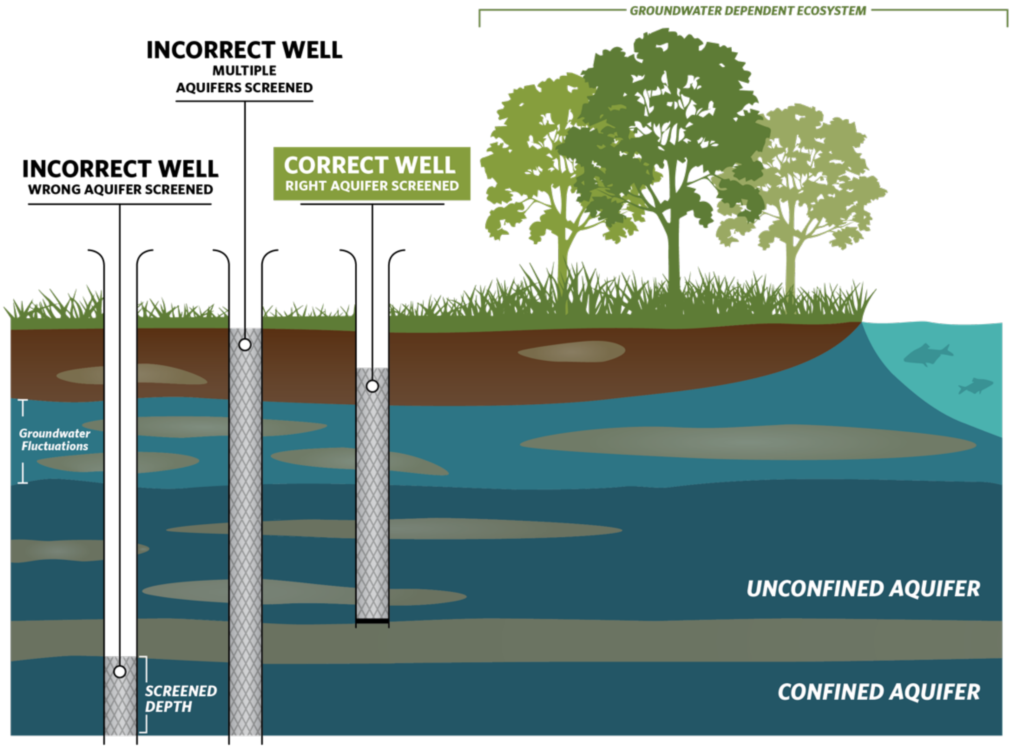

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

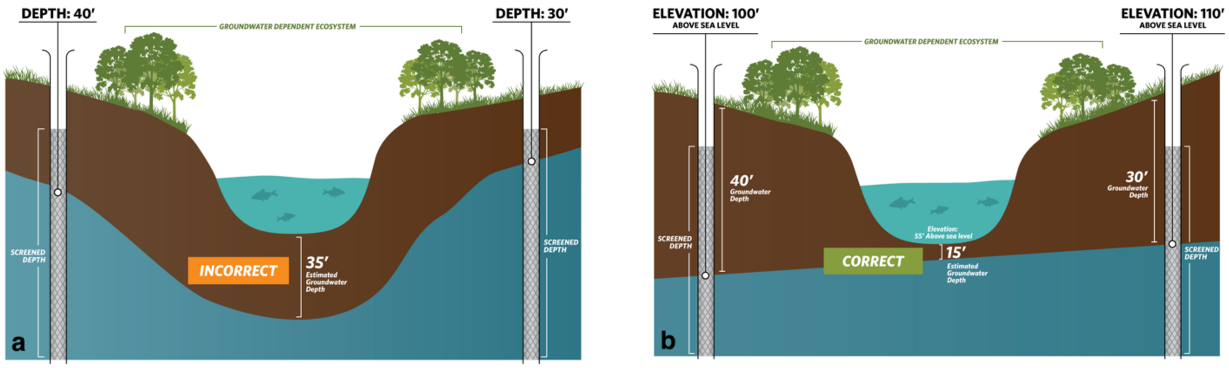

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

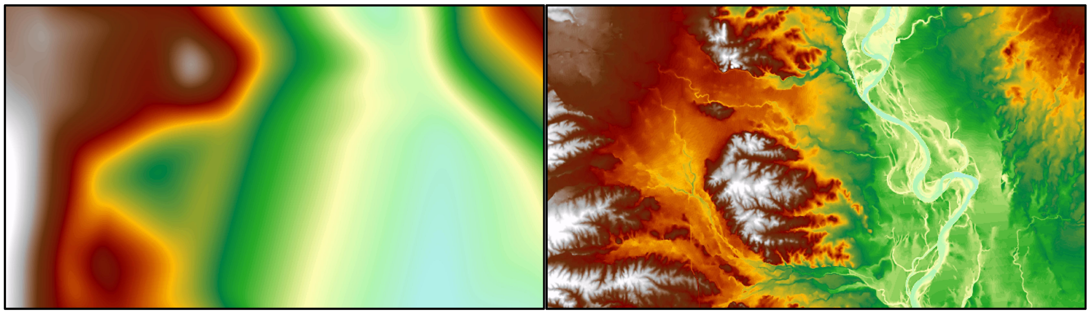

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

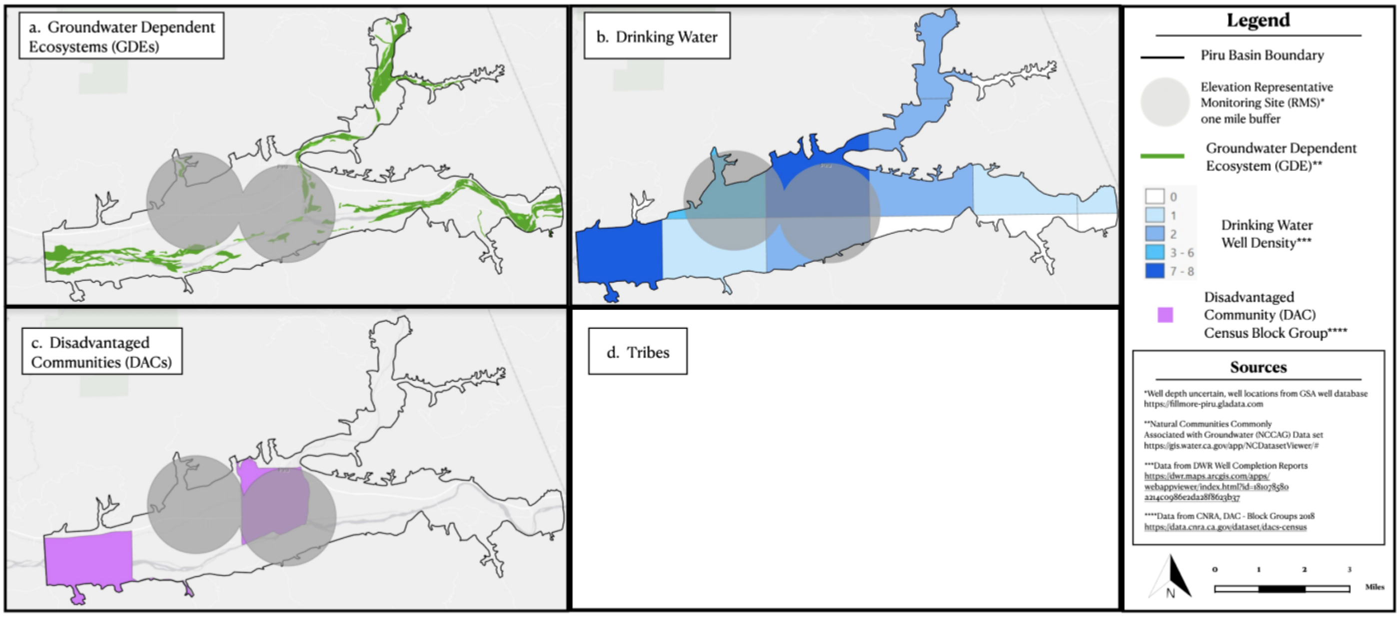

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

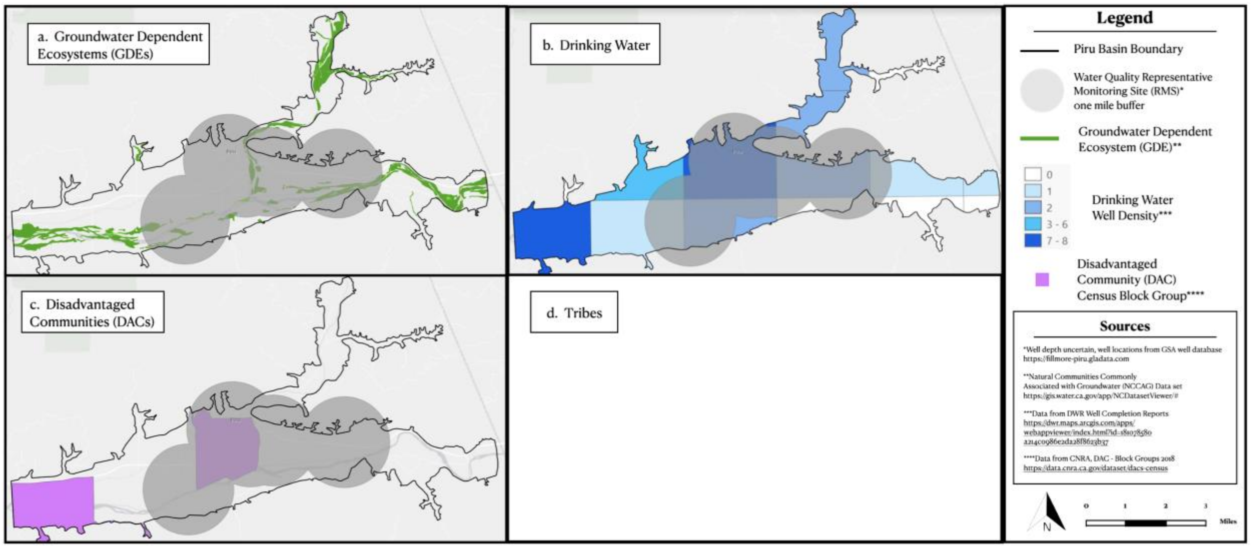

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

December 20, 2021

Pleasant Valley GSA
P.O. BOX 468,
Coalinga, CA 93210

Submitted via email: info@sgma.pleasantvalleywaterdistrict.com

Re: Public Comment Letter for Pleasant Valley Subbasin Draft GSP

Dear Calvin Monreal and Katie Durham,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Pleasant Valley Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.

2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Pleasant Valley Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Pleasant Valley Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP provides information on the identified DAC (City of Coalinga), including identification by name, location on a map (Figure I-2), and the size of the population. While the GSP identifies the water sources for the City of Coalinga in Table 2-5, it should clearly identify the City as an identified DAC in this table and thereby clearly indicate the water sources for DACs in the subbasin.

The GSP fails to provide a density map of domestic wells or information on the depth of domestic wells (such as minimum well depth, average well depth, or depth range) within the subbasin. This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the subbasin.

These missing elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• In Table 2-5, clearly identify the City of Coalinga as a DAC within the subbasin. • Provide a domestic well density map and include average well depth across the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP states (p. 3-64): *"Groundwater within the Subbasin is generally encountered at depths between 300 to 500 feet below ground.*

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

Due to the natural intermittent nature of surface water in the Subbasin and the depths to groundwater, the Subbasin does not have interconnected surface water and groundwater as defined in the SGMA regulations." The GSP presents depth to groundwater contours in FIgures 3-18 and 3-19, however there is no groundwater elevation data in the western portion of the subbasin. The GSP states (p. 5-20): "*There are no known interconnected surface water systems within the Subbasin, although there are areas where they may exist on the western border. No information is available to assess potential surface water-groundwater interconnection in these areas since there are no wells, and hence no groundwater pumping."* We recommend the GSP discuss the gaps in data needed to adequately characterize the interaction between groundwater and surface water within the subbasin. The GSP should consider any segments with data gaps as potential ISWs and clearly marked as such on maps provided in the GSP.

The GSP states that the groundwater system in the subbasin is comprised of an upper unconfined aquifer and a semi-confined aquifer at greater depths. We recommend that the GSP discuss the screening depths of wells used in developing the groundwater contours for the ISW analysis to ensure that depth to groundwater data used for the analysis represents the upper unconfined aquifer.

RECOMMENDATIONS
● Discuss the screening depths of wells in the subbasin. Ensure that groundwater data used in the ISW analysis represent the upper unconfined aquifer. ● Provide a map of streams in the subbasin. Clearly label reaches as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP. ● For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, insufficient groundwater data was used to characterize groundwater conditions underlying the subbasin's GDEs. The GSP uses depth-to-groundwater data from 2019 to characterize areas where the depth to groundwater was less than 200 feet to identify potential GDEs. We recommend using groundwater data from multiple seasons and water year types to determine the range of depth to groundwater around NC dataset polygons. Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying GDEs and is necessary to capture the variability in groundwater conditions inherent in California's Mediterranean climate.

The GSP does not provide an inventory of the flora or fauna species present in the subbasin's GDEs. Furthermore, the GSP does not acknowledge endangered, threatened, or special status species in the subbasin.

RECOMMENDATIONS

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- Include an inventory of the fauna and flora present within the subbasin's GDEs (see Attachment C of this letter for a list of freshwater species located in the Pleasant Valley Subbasin). Note any threatened or endangered species.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of native vegetation into the water budget is **insufficient**. The water budget did not include the current, historical, and projected demands of native vegetation. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the subbasin.

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.

[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

- State whether or not there are managed wetlands in the subbasin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development
Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Pleasant Valley Communication and Engagement Plan.[4]

We note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement in very general terms for listed stakeholders. Public notice and engagement activities include educational and outreach meetings with Spanish translation services, distribution of stakeholder surveys, question and answer sessions, solicitations for stakeholder input, opportunities for GSP comments, presentations to government agencies, outreach meetings for stakeholders, public hearings, and printed materials with Spanish translations including fliers, fact sheets, letters, newsletters, and presentation materials. The GSP does not state whether there was direct engagement with DACs, or whether DACs are represented on a GSP Advisory Committee or Board for the subbasin.

- The plan does not include documentation on how stakeholder input from the above-mentioned outreach and engagement was solicited, considered and incorporated into the GSP development process.

- The GSP fails to identify environmental stakeholders within the subbasin in order to consider and incorporate the interest of environmental users in the GSP development process. We recommend that the GSAs engage with environmental stakeholders such as the California Department of Fish and Wildlife or environmental non-profits.

- Page V-2 of Communication and Engagement Plan states: *"Printed materials will incorporate the visual imagery established through branding efforts and will be tailored for specific means of communication throughout the phases of GSP development, public review, and implementation,"* suggesting that plans for outreach to all identified stakeholders will continue during the implementation phase of the GSP. However, the GSP does not include a detailed plan for continual opportunities for engagement through the implementation phase of the GSP that is specifically directed to DACs, domestic well owners, and environmental stakeholders within the subbasin. The plan should also clarify whether a GSP Advisory Committee exists for the subbasin and if it will continue to meet and inform the GSP implementation for the subbasin after the GSP is adopted by the GSAs.

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[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

RECOMMENDATIONS

- In the Communication and Engagement Plan, describe active and targeted outreach to engage DACs, drinking water users, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Engage with environmental stakeholders in the subbasin, which could include California Department of Fish and Wildlife or environmental non-profits.

- Provide documentation on how stakeholder input was incorporated into the GSP development process.

- Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the subbasin.[5]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, minimum thresholds are defined in terms of reducing the rate of the decline in water levels over time. Minimum threshold elevations are set to levels well below historical minimums. The GSP does not mention or discuss the impacts of groundwater levels on domestic wells in the subbasin. Therefore, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users, especially given the absence of a domestic well mitigation plan in the GSP. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs or drinking water users when defining undesirable results, nor does it describe how the groundwater level minimum thresholds are consistent with Human Right to Water policy and will avoid significant and unreasonable impacts on these beneficial users.[9]

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[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

For degraded water quality, the GSP only establishes SMC for electric conductivity (EC). The minimum threshold for groundwater quality for the subbasin is set to an EC of 5,000 micromhos/cm, designed to be protective of pistachio crops. However, this value is well above the upper secondary maximum contaminant limit (MCL) for EC of 1,600 micromhos/cm. According to the state's anti-degradation policy,[10] water quality should be protected and is only allowed to worsen to the MCL if a finding is made that it is in the best interest of the people of the State of California. No analysis has been done and no such finding has been made. Furthermore, Section 3.2.5 of the GSP (Groundwater Quality Issues) discusses other constituents of concern (COCs) in the subbasin. Significantly, nitrate is an acute contaminant which, at levels above the maximum contaminant level, can affect public health. This is a particular concern for domestic wells, as nitrate exceedances do not affect the taste or smell of the water. All COCs in the sub basin that may be impacted or exacerbated by groundwater use and/or management should be included in the SMC, in addition to coordinating with water quality regulatory programs.

The GSP does not mention or discuss direct and indirect impacts on DACs or drinking water users when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs or drinking water users.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users and DACs when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels. Include information on the impacts during prolonged periods of below average water years.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users and DACs within the subbasin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be fully or partially de-watered at the minimum threshold.

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users and DACs when defining undesirable results for degraded water quality.[11] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[12]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users and DACs.

[10] Anti-degradation Policy
https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf

[11] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[12] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act
https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management.
- Set minimum thresholds that do not allow water quality to degrade to levels at or above the MCL trigger level.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC.

The GSP does not establish SMC for depletion of interconnected surface water. The GSP states (p. 4-42): *"As described in Chapter 3, groundwater levels are very deep compared to surface features. There are only small areas of land where groundwater levels may be in close proximity to the surface water feature. These may occur where the creek systems exit the more mountainous terrain in the western portion of the Subbasin. In general, these areas are not developed, are still within the canyon before opening into the Subbasin, have shallow alluvium, have steep slopes, are in areas where the land activity is devoted to cattle grazing, and are more than two miles from active wells used for agricultural production. It is for these reasons that this sustainability indicator is considered not likely to occur and sustainable management criteria are not established."* The GSP should further discuss data gaps for GDEs and ISWs, and provide specific plans to fill these data gaps in the monitoring network and projects and management actions sections of the GSP. While these data gaps are being filled, the GSP could be improved by including further discussion of significant and unreasonable effects for GDEs and ISWs in the subbasin, including surface water beneficial users (see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration). As SMC that consider GDEs and ISWs are established in the future, note our further recommendations below.

RECOMMENDATIONS

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."
- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the

subbasin.[13] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[14]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[15] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[8,16]

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[17] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[18] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for both 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring and their consideration is not required (only suggested) by DWR, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

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[13] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[14] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[15] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[16] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[17] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[18] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

The GSP integrates climate change into key inputs (e.g., changes in precipitation and evapotranspiration) of the projected water budget. However, the plan fails to include surface water flow inputs (inclusive of imported water to the City of Coalinga) for the projected water budget and incorporate the effects of climate change on these flows. Additionally, the two sustainable yield estimates provided in the GSP are not calculated based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, omission of projected climate change effects on imported water inputs, and omission of climate change projections in the sustainable yield calculations, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Include surface water flow inputs, inclusive of imported water, in the projected water budget and incorporate climate change effects on these flows.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of adequate plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, and GDEs in the subbasin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[19]

Figure 5-2 (Groundwater Level Representative Network) and Figure 5-3 (Water Quality Network) show insufficient representation of DACs and drinking water users for groundwater elevation and water quality monitoring. Furthermore, the GSP fails to provide discussion of data gaps for GDEs and ISWs. The GSP states in Section 5.10.6.2 (Identification of Interconnected Surface Water Data Gaps): *"The Subbasin does not recognize any data gaps at this time."* However, the GSP appears to acknowledge these data gaps with the following statement (p. 5-20): *"There are no known interconnected surface water systems within the Subbasin, although there are areas where they may exist on the western border. No information is available to assess potential surface water-groundwater interconnection in these areas since there are no wells, and hence no groundwater pumping."* We recommend that the GSP further discuss these data gaps and provide specific plans, such as locations and a timeline, to fill them.

[19] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify monitored areas.
- Increase the number of RMSs in the shallow aquifer across the subbasin as needed to map ISWs and adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMSs.
- Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.
- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

The GSP includes recharge and habitat restoration projects with explicit benefits to the environment, such as the North Pipeline Project and Los Gatos Creek Gravel Pits Recharge Project. However, the GSP fails to describe this or other projects' explicit benefits or impacts to other beneficial users such as DACs or drinking water users.

We note that the plan does not include a domestic well mitigation program to avoid significant and unreasonable loss of drinking water. We recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells for DACs and domestic users through GSP implementation.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSAs plan to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[20]

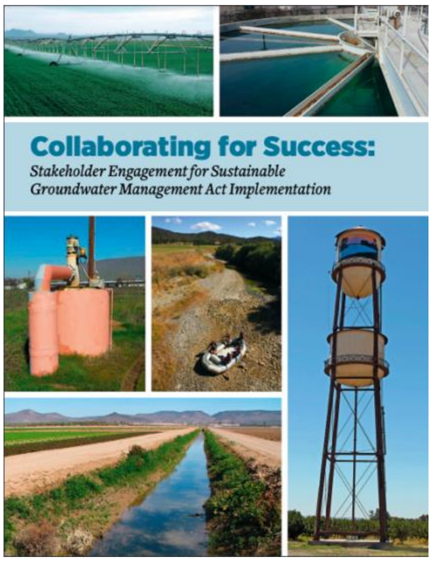
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[20] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

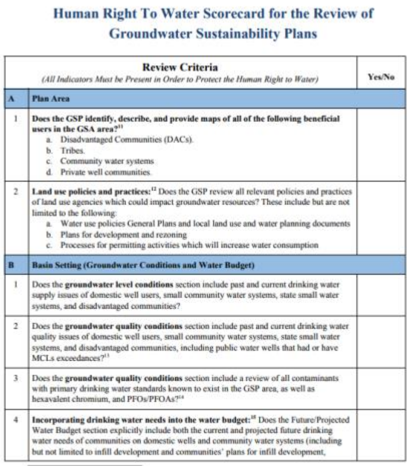
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

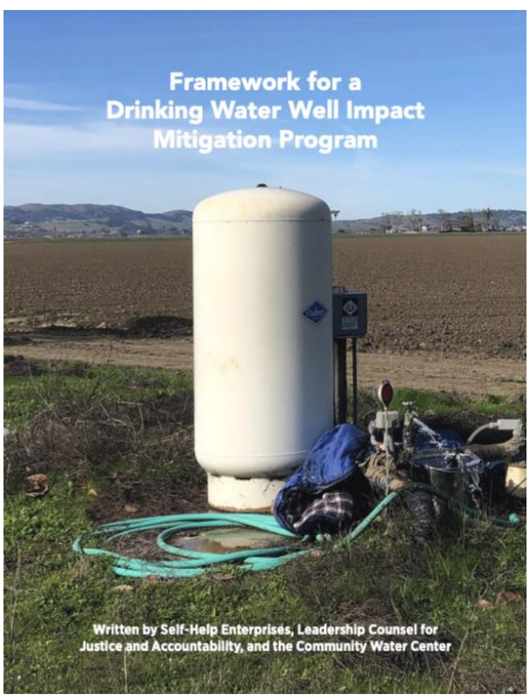


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

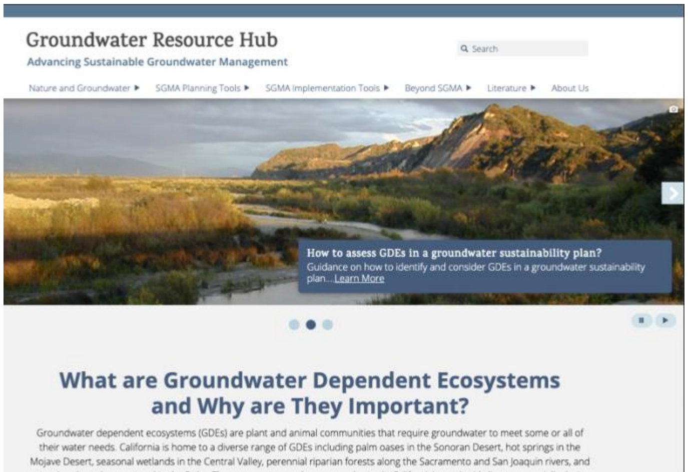
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



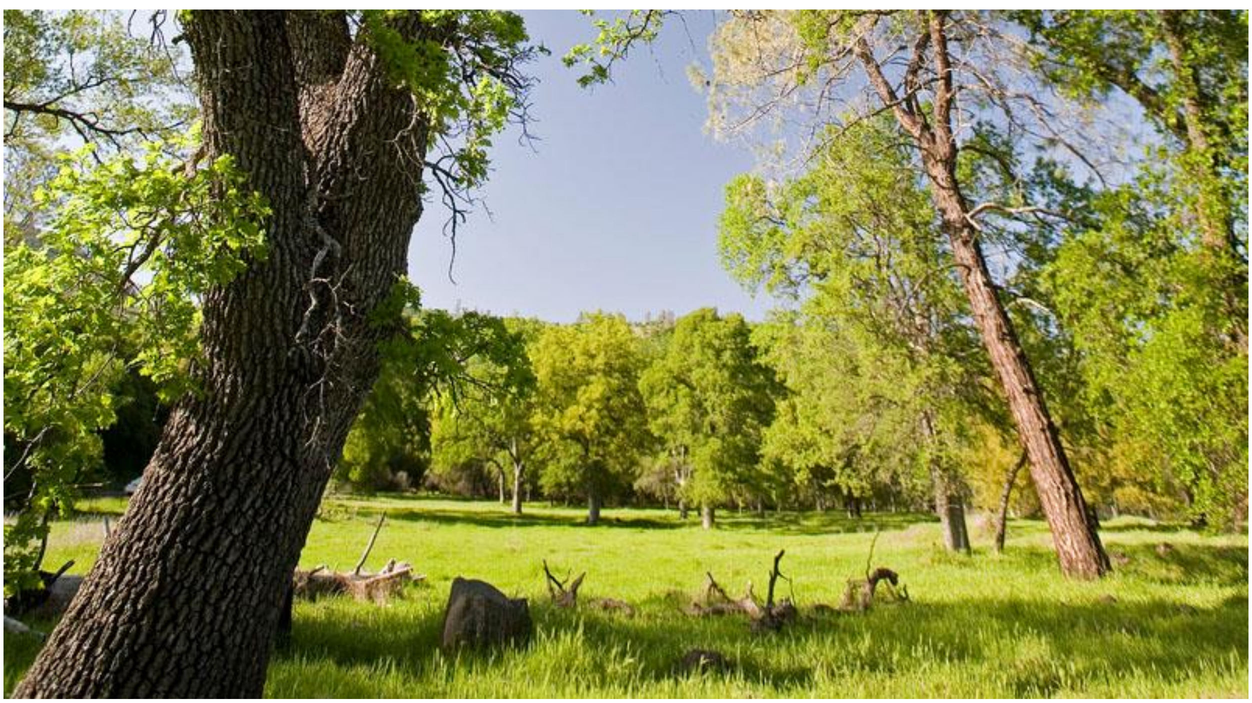
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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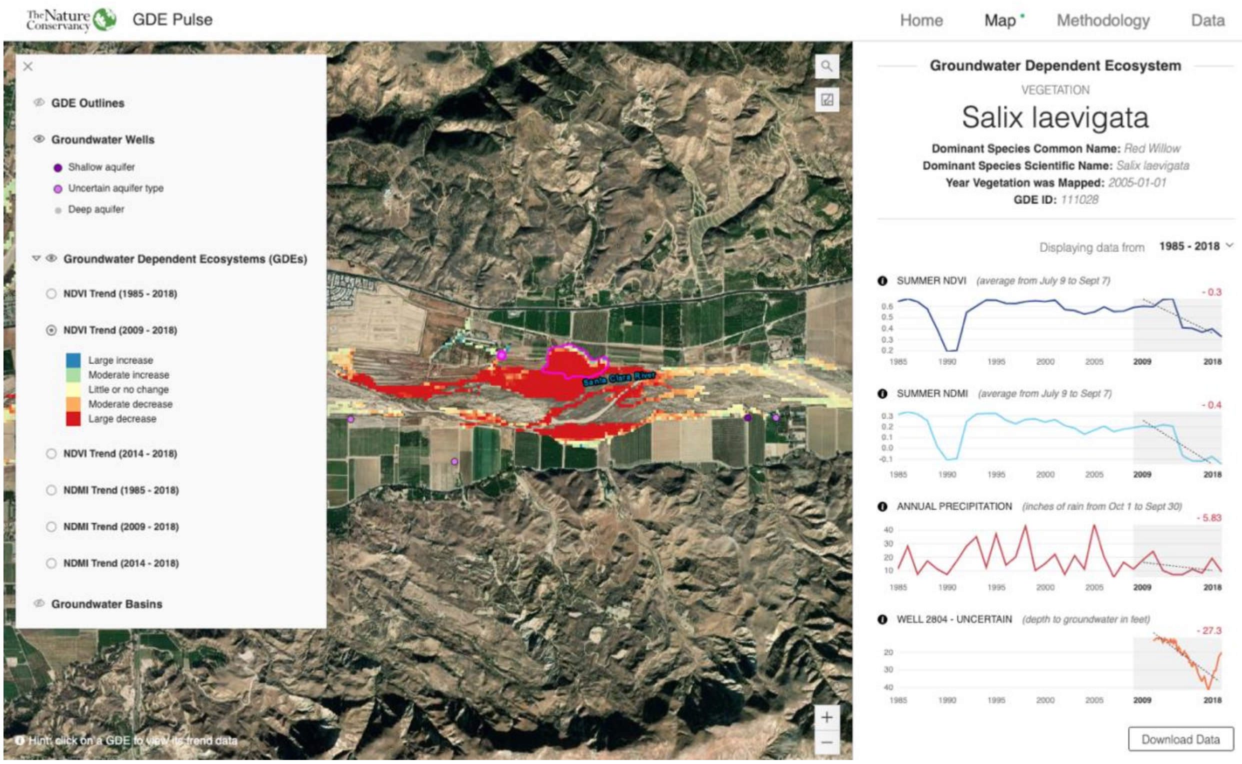
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

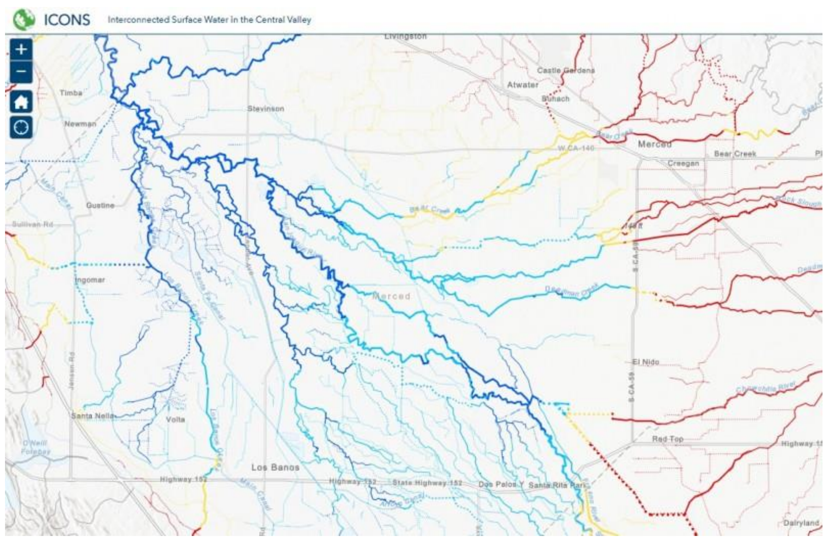
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California’s Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy’s ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Pleasant Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Pleasant Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Pseudacris regilla	Northern Pacific Chorus Frog			
PLANTS				
Baccharis salicina				Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Myosurus minimus	NA			

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

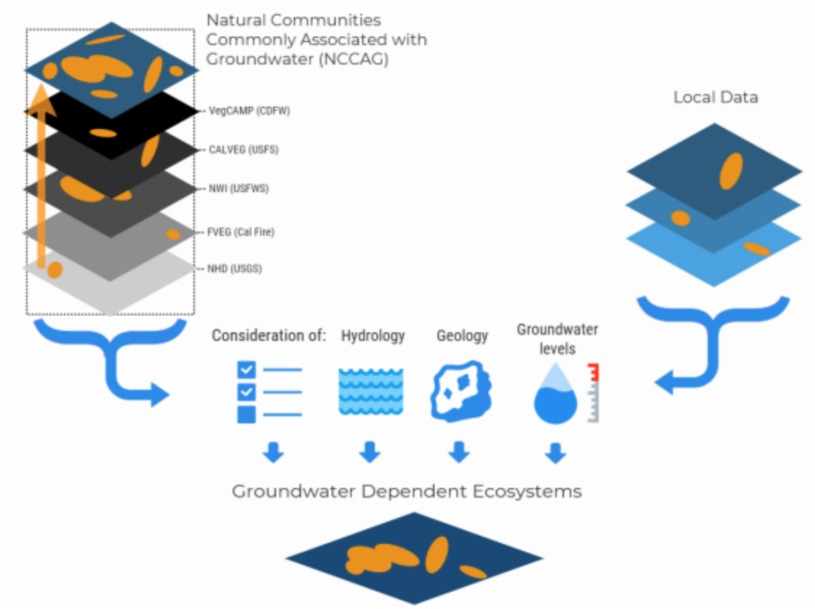


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

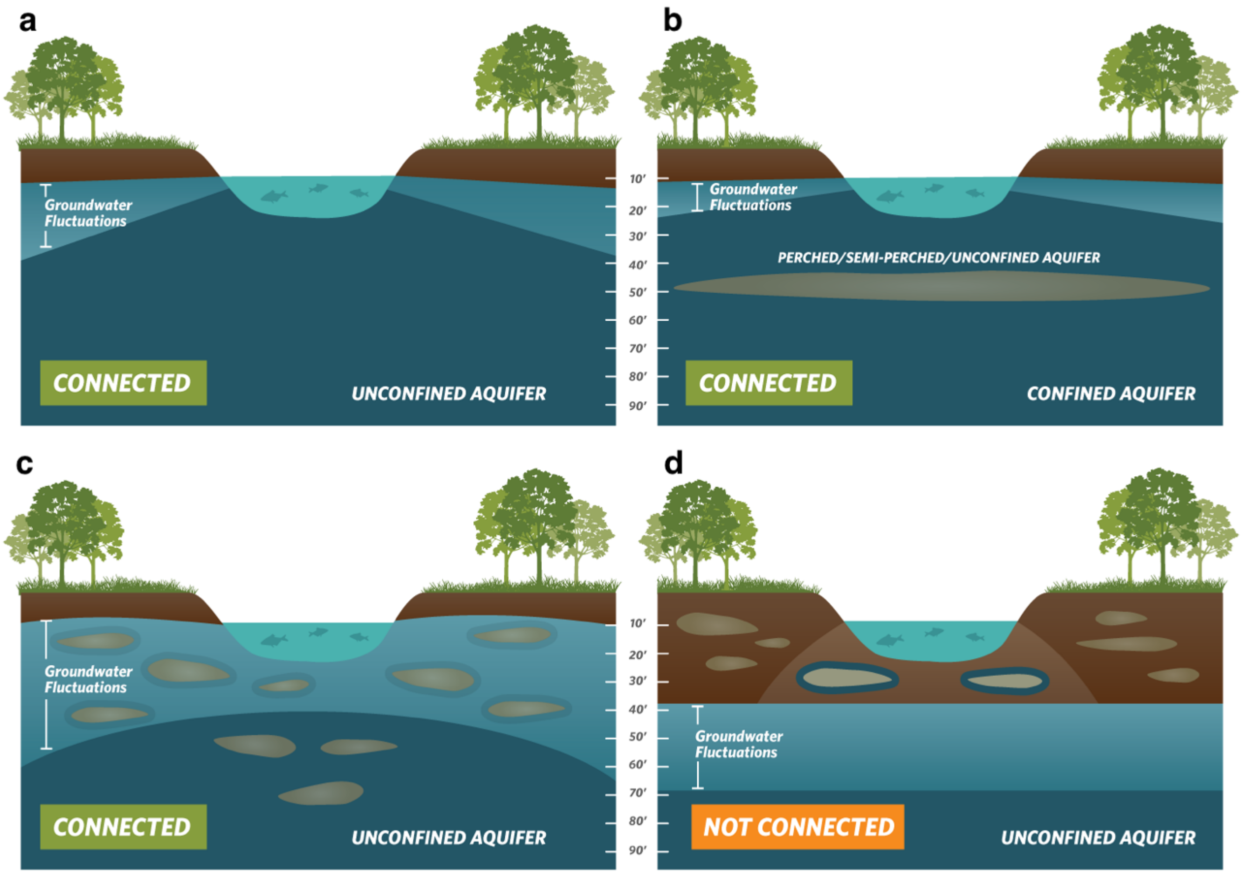


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

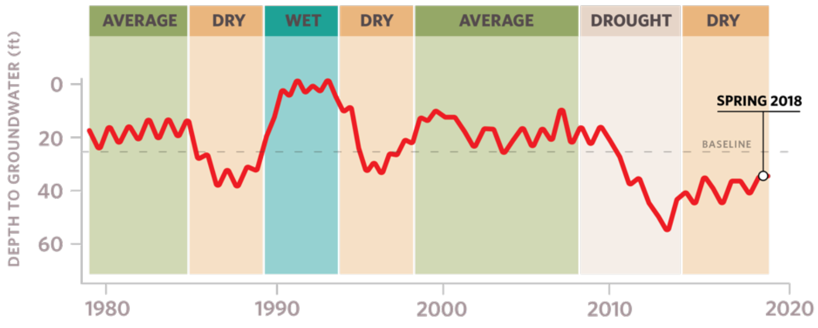


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

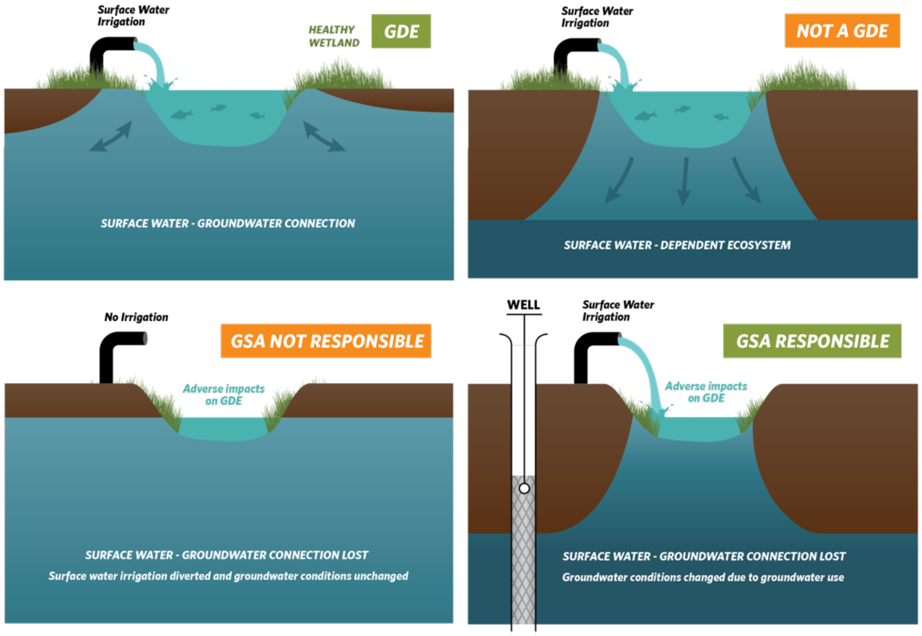


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

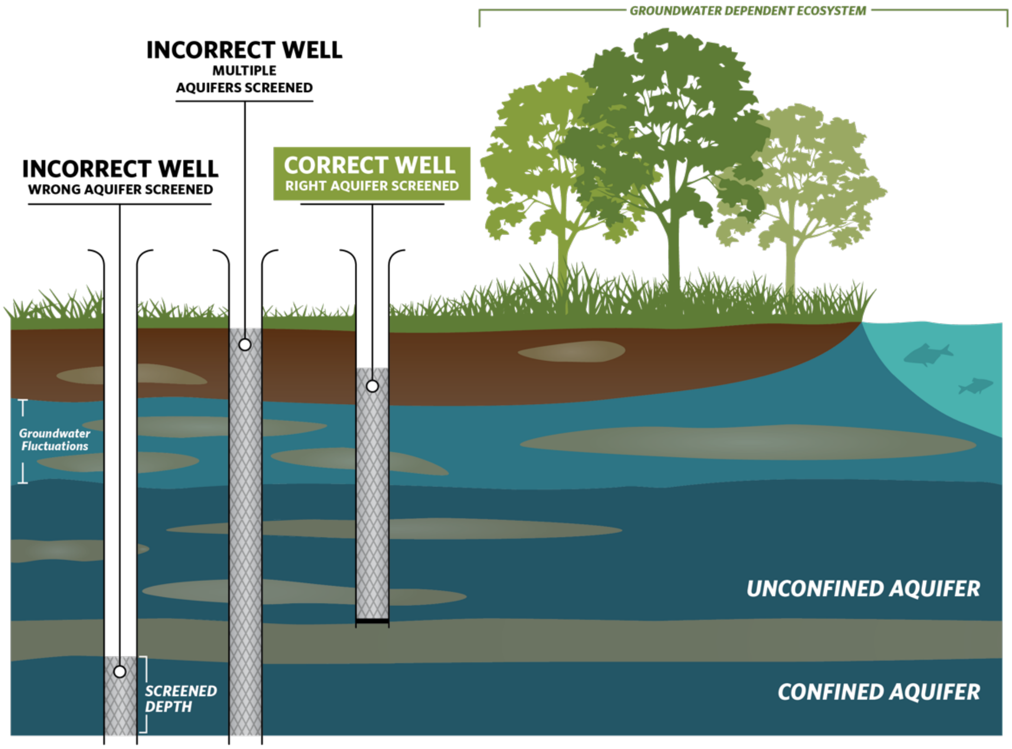


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

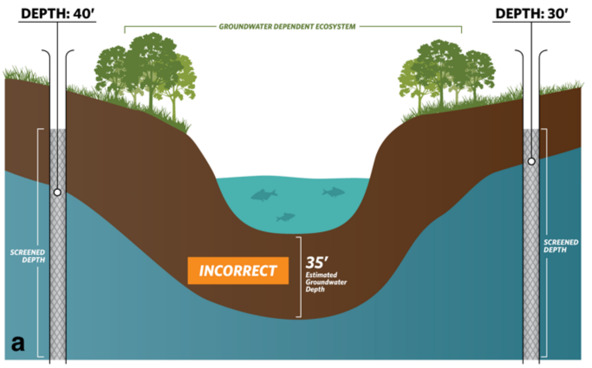


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

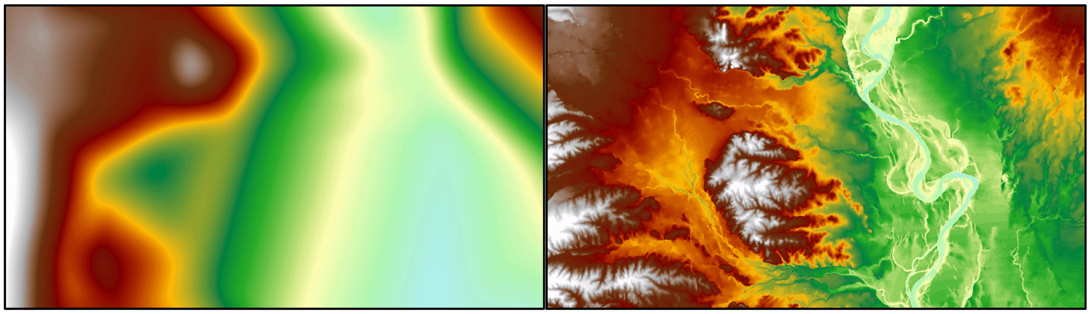


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

November 19, 2021

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Gerber, CA 96035

Submitted via email: nbethurem@tcpw.ca.gov

Re: Public Comment Letter for Red Bluff Subbasin Draft GSP

Dear Nichole Bethurem,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Red Bluff Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Red Bluff Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

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Attachment A

Specific Comments on the Red Bluff Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. We note the following deficiencies with the identification of these key beneficial users.

- The GSP erroneously maps “Economically Disadvantaged Areas” rather than “Disadvantaged Communities” in Figure 2-11. The GSP must map the locations of DACs within the subbasin, identify each DAC by name, and provide the population of each DAC. The GSP also fails to identify the population dependent on groundwater as their source of drinking water in the subbasin.

- The plan identifies the Greenville Rancheria Tribe as a stakeholder within the subbasin, but does not provide a map of the tribal lands or tribal interests in the subbasin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide a map that identifies each DAC in the subbasin by name and provide the population of each identified DAC. Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). • Provide a map of tribal lands and describe tribal interests in the subbasin.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources’ “Engagement with Tribal Governments” Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP describes the use of a groundwater model (Tehama Integrated Hydrologic Model) to analyze the interaction between groundwater and surface water within the subbasin. While Appendix 2-J gives a detailed description of the model, the GSP could be improved by including a summary in the main GSP text. This information should include groundwater level monitoring well data and stream gauge data that were incorporated into the model, the screening depths of wells used in the groundwater model, and description of the temporal (seasonal and interannual) variability of the data used to calibrate the model.

The GSP does not provide any concluding statements in the GSP text about which reaches are considered to be interconnected. Figure 2-56 (Surface Water and Shallow Groundwater Monitoring Stations) presents stream reaches in the subbasin labeled as perennial and intermittent/ephemeral. However, this figure does not label reaches as interconnected, disconnected, or reaches with data gaps.

RECOMMENDATIONS
• Provide a map showing all the stream reaches in the subbasin, with reaches clearly labeled as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP. • In the main text of the GSP, summarize the groundwater elevation data and stream flow data used in the modeling analysis. Discuss temporal (seasonal and interannual) variability of the data used to calibrate the model. • To confirm and illustrate the results of the groundwater modeling, overlay the subbasin's stream reaches with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis. • For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). Potential GDEs were identified in areas overlying groundwater within 30 feet of land surface based on Spring 2015 groundwater conditions, but this was the only dataset used to characterize groundwater conditions in the subbasin's GDEs. We recommend using groundwater data from multiple seasons and water year types over the pre-SGMA period (i.e., 2005-2015) to determine the range of depth to groundwater. Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying GDEs and is necessary to capture the variability in groundwater conditions inherent in

California's Mediterranean climate. The GDE Appendix (Appendix 2-H) refers to Figure 1 through Figure 4 that illustrate the steps of the GDE analysis. These figures appear to be missing from the appendix, however.

The GSP does not provide an inventory of flora and fauna in the subbasin, nor is any discussion of threatened or endangered species provided.

RECOMMENDATIONS

- Include the missing Figures 1-4 in the GDE Appendix 2-H.

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as Valley Oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether Valley Oak polygons from the NC Dataset are connected to groundwater. It is important to emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and proximity to other water sources.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- Provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin and note any threatened or endangered species (see Attachment C in this letter for a list of freshwater species located in the Red Bluff Subbasin).

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of native vegetation into the water budget is **sufficient**. We commend the GSA for including the groundwater demands of this ecosystem in the historical, current and projected water budgets. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the subbasin.

RECOMMENDATION
• State whether or not there are managed wetlands in the subbasin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Communications and Engagement Plan (Appendix 2-A).[4]

We note the following deficiencies with the overall stakeholder engagement process:

- The GSP identifies the Greenville Rancheria as tribal stakeholders present within the subbasin. Appendix C (of the Communications and Engagement Plan) describes Tribal Engagement in Tehama County. This appendix describes outreach principles, outreach partners, and steps to be taken for tribal engagement. However, the GSP does not state what steps were actually taken or the results of tribal engagement actions.

- The GSP documents opportunities for public involvement and engagement in general terms for listed stakeholders. Public outreach and engagement activities include public meetings, public hearings, workshops, notices to cities and counties within the subbasin, stakeholder briefings, newsletters, and updates to the GSA website. While the GSP provides a guidance document on DAC engagement, its description consists primarily of informing DACs by outreach to DAC-related organizations. The GSP does not state whether DACs and environmental stakeholders are represented on a GSA Advisory Committee or Board.

- The plan does not include documentation on how stakeholder input from the above mentioned outreach and engagement was considered and incorporated into the GSP development process.

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[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- We note that Appendix G (of the Communications and Engagement Plan) is still under development and will include more details of outreach to stakeholders during GSP implementation. Ensure that as this section is finalized, it includes a detailed plan for continual opportunities for engagement through the implementation phase of the GSP that is specifically directed to DACs, domestic well owners, and environmental stakeholders.

RECOMMENDATIONS

- In the Communications and Engagement Plan, describe active and targeted outreach to engage all stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. While some of these resources have already been stated in the GSP, we recommend that the GSA should improve utilization of these resources and documentation of the engagement process.

- Provide documentation on how stakeholder input was incorporated into the GSP development process.

- Provide information on whether the GSA has initiated contact with tribal stakeholders in the subbasin during GSP development, and how tribal concerns were considered during the GSP development process.

- Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the subbasin.[5]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP states (p. 3-23): *"The MTs were set to the following: Upper Aquifer: Spring groundwater elevation where less than 10 - 20% (on average) of domestic wells could potentially be impacted."* No further details are provided on the minimum threshold impacts to domestic wells, including the methodology used to conduct the assessment. The GSP does not sufficiently describe whether minimum thresholds will avoid significant and

[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, nor does it describe how the groundwater levels minimum thresholds are consistent with the Human Right to Water policy.[9]

The undesirable result for chronic lowering of groundwater levels is established as (p. 3-37): *"25% of groundwater elevations measured at the same RMS wells exceed the associated MTs for 2 consecutive measurements. If the water year is dry or critically dry, then levels below the MTs are not undesirable if groundwater management allows for recovery in average or wetter years."* By only using minimum threshold exceedances during non-drought years to define undesirable results for groundwater levels, significant and unreasonable impacts to beneficial users experienced during dry years or periods of drought will not result in an undesirable result. This is problematic since the GSP is failing to manage the subbasin in such a way that strives to minimize significant adverse impacts to beneficial users, which are often felt greatest in below-average, dry, and drought years. Furthermore, the requirement that 25% of monitoring wells exceed the minimum threshold before triggering an undesirable result means that areas with high concentrations of domestic wells may experience impacts significantly greater than the established minimum threshold because the 25% threshold isn't triggered.

For degraded water quality, minimum thresholds are set for total dissolved solids (TDS) to 750 milligrams per liter (mg/L), lower than the upper secondary maximum contaminant level (SMCL) of 1,000 mg/L. This is the only constituent of concern (COC) for which SMC are established. Section 2.1.4.6 (Migration of Contaminated Groundwater) and Section 2.2.2.3 (Groundwater Quality) discuss other COCs, both naturally occurring and those associated with industrial activities, that have exceeded regulatory standards. Significantly, nitrate is an acute contaminant which, at levels above the maximum contaminant level, can affect public health. This is a particular concern for domestic wells, as nitrate exceedances do not affect the taste or smell of the water. SMC should be established for all COCs in the subbasin that may be impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs, domestic well owners, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels. Include information on the impacts during prolonged periods of below average water years.

- Consider minimum threshold exceedances during drought years when defining the groundwater level undesirable result across the subbasin.

Degraded Water Quality

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when defining undesirable results for degraded water quality.[10] For specific guidance on how

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

[10] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[11]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs, drinking water users, and tribes.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that are impacted or exacerbated by groundwater use and/or management.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC.

Sustainable management criteria for depletion of interconnected surface water are established by proxy using groundwater levels. The GSP states (p. 3-32): "*Minimum thresholds are interim and will be the same water levels used in for the chronic lowering of groundwater elevations described in Section 3.3.1.1. Extensive data gaps are discussed in Section 3.7.8.7. The GSA will continue to evaluate new monitoring information and determine these thresholds later."* While the GSP clearly recognizes the data gap for depletion of interconnected surface water SMC, we would like to see further discussion of how the interim SMC will affect beneficial users, and more specifically GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. The GSP makes no attempt to evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the

[11] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

subbasin.[12] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[13]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[14] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,15]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[16] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[17] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a

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[12] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[13] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[14] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[15] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[16] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[17] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP integrates climate change into key inputs (e.g., changes in precipitation, evapotranspiration, and surface water flow) of the projected water budget, and calculates a sustainable yield based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, tribes, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, tribes, GDEs, and ISWs in the subbasin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[18]

Figure 3-1 (Representative Monitoring Sites) shows insufficient representation of DACs, drinking water users, and tribes for water quality monitoring. Figure 3-2 (Groundwater Level Representative Monitoring Sites – Upper Aquifer) and Figure 3-3 (Groundwater Level Representative Monitoring Sites – Lower Aquifer) show insufficient representation of DACs, drinking water users, tribes, and GDEs for groundwater elevation monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater.

The GSP provides some discussion of data gaps for GDEs in Section 3.7.8.7 (Assessment and Improvement of Monitoring Network - Interconnected Surface Waters), but does not provide specific plans, such as locations or a timeline, to fill the data gaps. The GSP states (p. 3-23): *"The GSA will also install three (3) nested monitoring wells (TSS 1-3) in the Subbasin which is included in this monitoring network (Figure 3-7). These wells are designed to monitor both the upper and lower aquifers."* Figure 3-7 (Identification of Data Gaps (GDE)) maps high priority GDEs alongside existing shallow monitoring wells, but this figure does not show the additional proposed monitoring well locations.

[18] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, tribes, and GDEs to clearly identify monitored areas.

- Increase the number of RMSs in the shallow aquifer across the subbasin as needed to map ISWs and adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, tribes, GDEs, and ISWs when identifying new RMSs.

- Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, tribes, and GDEs.

- Further describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin. Additional studies of GDEs and groundwater - surface water interactions are briefly discussed in the Projects and Management Actions chapter, but very few details are provided.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **incomplete**. The GSP identifies the benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs and DACs. However, projects and management actions to improve water supply and GDE habitats (e.g., Invasive Species Plant Control, Levee Setback and Stream Channel Restoration) are described as potential projects without a known timeline for implementation.

We commend the GSA for describing the environmental benefits of the Multi-Benefit Recharge Project (Section 4.3.3) in the subbasin, as developed with support and guidelines from The Nature Conservancy.

The GSP describes the Tehama County Domestic Well Tracking and Outreach Program (Section 4.5.2.6) and the Well Deepening or Replacement Program (Section 4.5.2.7). However, these programs are described as potential projects to be implemented on an as-needed basis, instead of projects that will be implemented within the GSP planning horizon. We strongly recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation.

RECOMMENDATIONS

- Describe the projected timelines for implementing the Invasive Species Plant Control and Levee Setback and Stream Channel Restoration projects and management actions in Chapter 4 of the GSP.

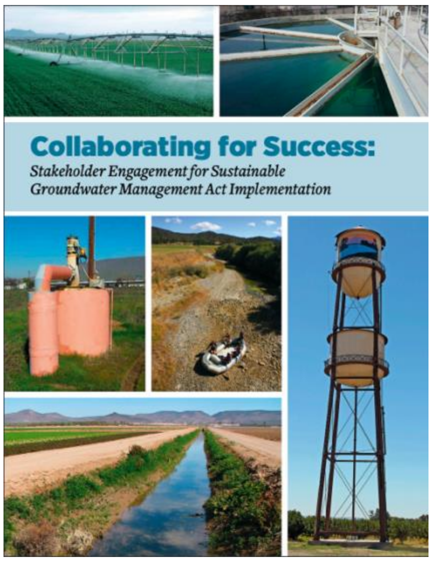
- For DACs and domestic well owners, provide specific plans for implementation of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



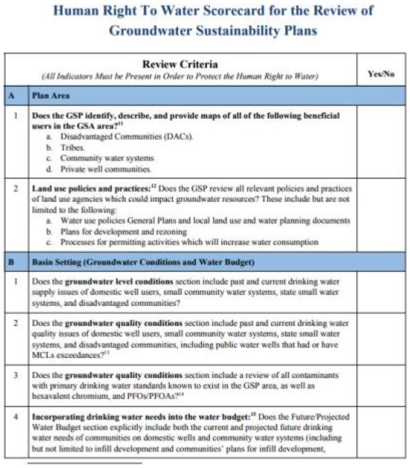
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

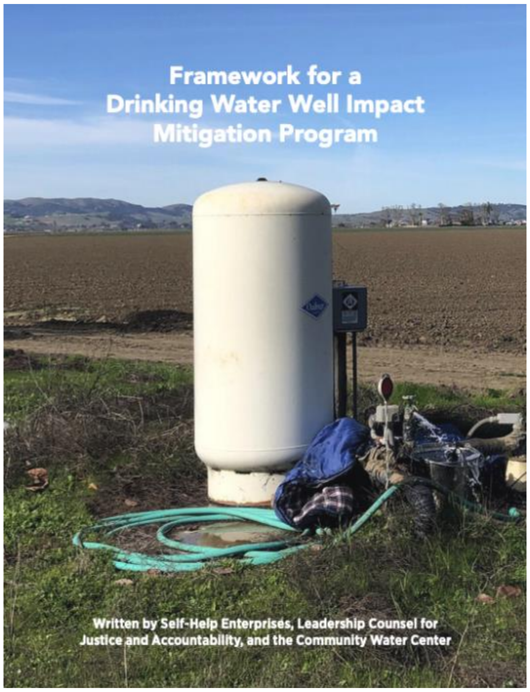


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

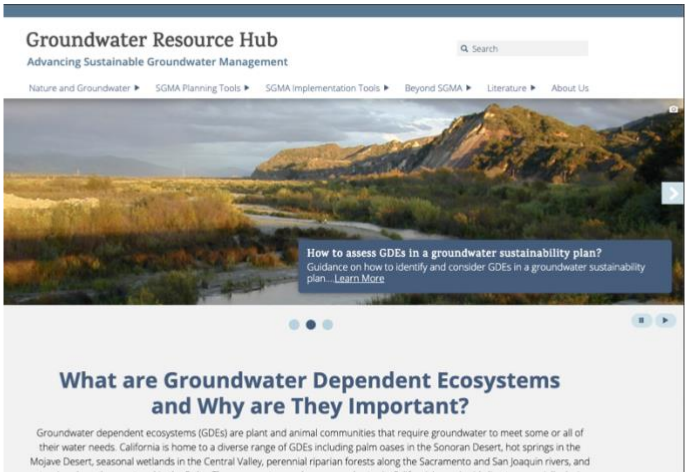
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



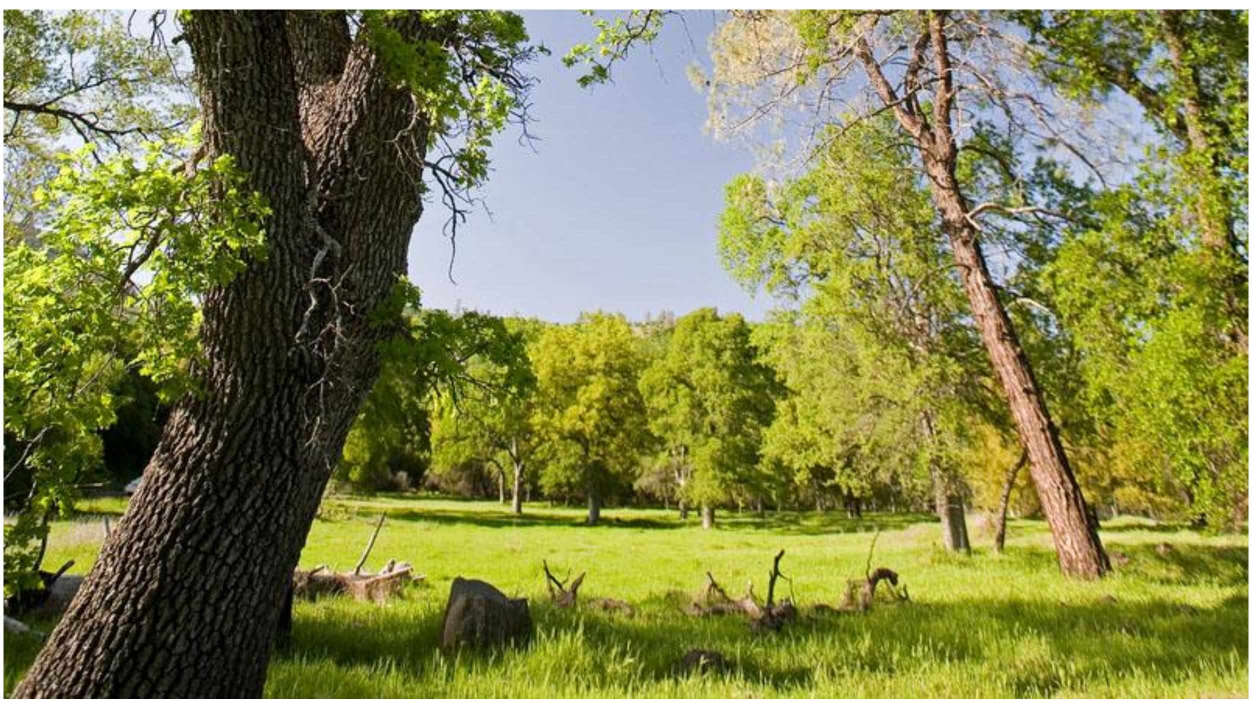
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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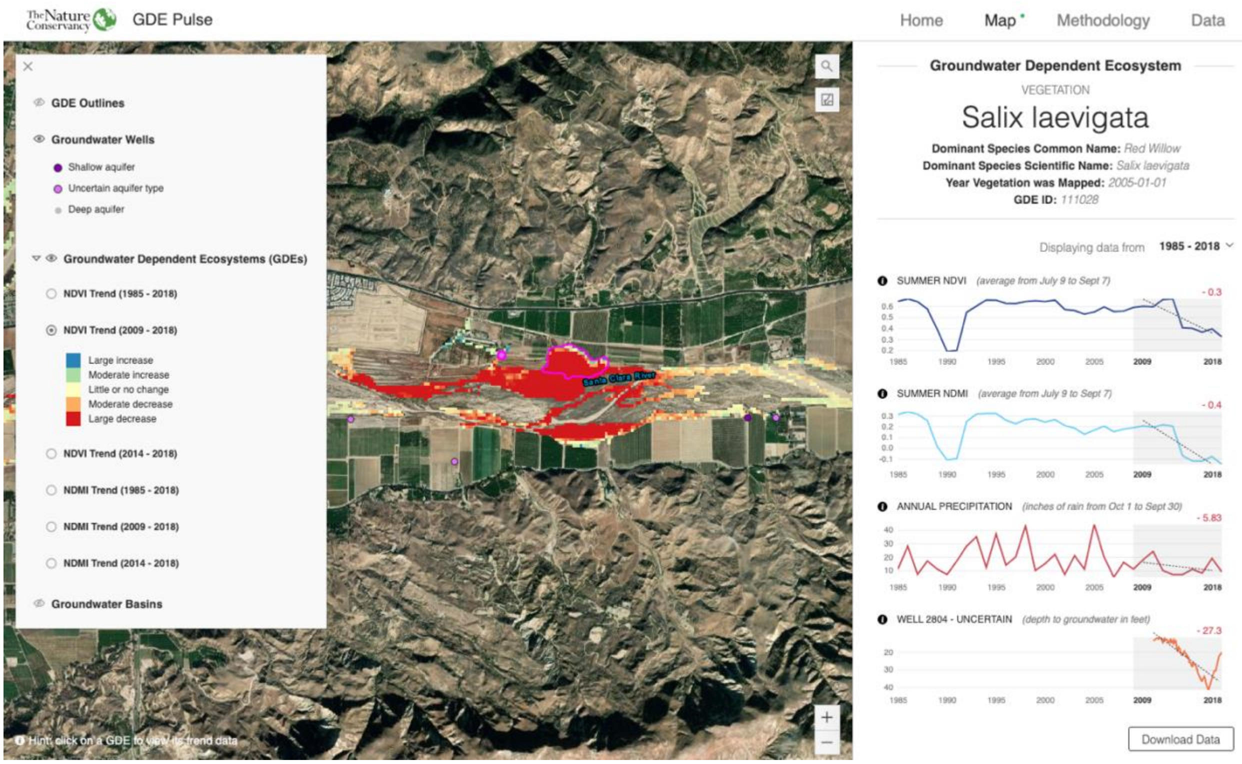
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

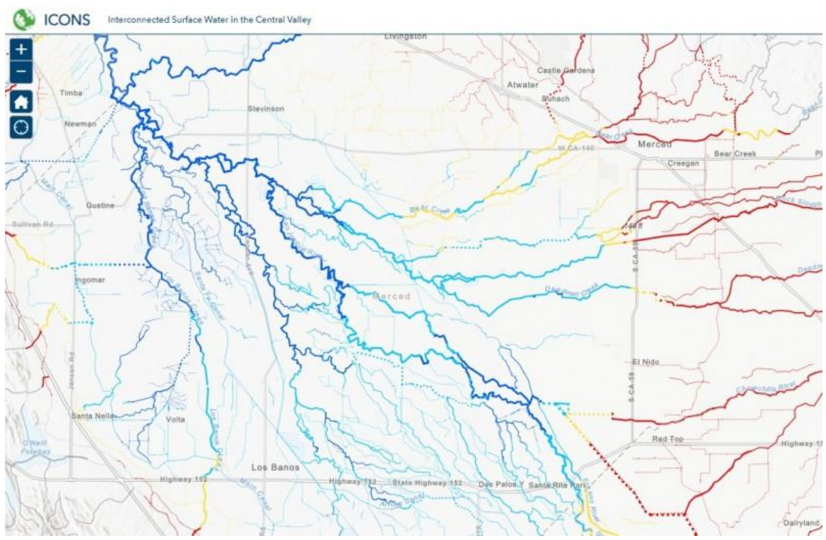
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Red Bluff Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Red Bluff Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Candidate - Threatened	Endangered	
Riparia riparia	Bank Swallow		Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya valisineria	Canvasback		Special	

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius phaeopus	Whimbrel			
Oxyura jamaicensis	Ruddy Duck			
Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Plegadis chihi	White-faced Ibis		Watch list	
Podilymbus podiceps	Pied-billed Grebe			
Rallus limicola	Virginia Rail			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
CRUSTACEANS				

Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endangered	Endangered	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Lithobates pipiens	Northern Leopard Frog		Special Concern	ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Thamnophis couchii	Sierra Gartersnake			
Thamnophis sirtalis sirtalis	Common Gartersnake			
Pseudacris regilla	Northern Pacific Chorus Frog			
Thamnophis sirtalis fitchi	Valley Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Ambrysus spp.	Ambrysus spp.			
Anax junius	Common Green Darner			
Antocha monticola				Not on any status lists
Argia agrioides	California Dancer			
Baetidae fam.	Baetidae fam.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			

Brachycentrus occidentalis				Not on any status lists
Brechmorhoga mendax	Pale-faced Clubskimmer			
Caenis latipennis	A Mayfly			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Epeorus albertae	A Mayfly			
Epeorus spp.	Epeorus spp.			
Ephemerella aurivillii	A Mayfly			
Fallceon quilleri	A Mayfly			
Glossosoma alascense	A Caddisfly			
Glossosoma spp.	Glossosoma spp.			
Hydropsyche alternans				Not on any status lists
Hydropsyche spp.	Hydropsyche spp.			
Ischnura perparva	Western Forktail			
Lepidostoma acarolum				Not on any status lists
Lepidostoma spp.	Lepidostoma spp.			
Leptophlebia spp.	Leptophlebia spp.			
Lestes congener	Spotted Spreadwing			
Libellula forensis	Eight-spotted Skimmer			
Marilia flexuosa	A Caddisfly			
Mystacides alafimbriatus	A Caddisfly			
Nectopsyche spp.	Nectopsyche spp.			
Nilotanypus spp.	Nilotanypus spp.			
Ophiogomphus occidentis	Sinuous Snaketail			
Optioservus canus	Pinnacles Optioservus Riffle Beetle		Special	
Optioservus quadrimaculatus				Not on any status lists
Optioservus spp.	Optioservus spp.			
Ordobrevia nubifera				Not on any status lists
Pachydiplax longipennis	Blue Dasher			
Polypedilum spp.	Polypedilum spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Reomyia spp.	Reomyia spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Rhyacophila acuminata	A Caddisfly			Not on any status lists
Simulium spp.	Simulium spp.			
Skwala americana	American Springfly			

Sweltsa adamantea				Not on any status lists
Sweltsa spp.	Sweltsa spp.			
Tanytarsus spp.	Tanytarsus spp.			
Tramea lacerata	Black Saddlebags			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
Zaitzevia parvula				Not on any status lists
Zaitzevia spp.	Zaitzevia spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Gonidea angulata	Western Ridged Mussel		Special	
Lymnaea spp.	Lymnaea spp.			
Lymnaea stagnalis	Swamp Lymnaea			Not on any status lists
Margaritifera falcata	Western Pearlshell		Special	
Physa acuta	Pewter Physa			Not on any status lists
Physa spp.	Physa spp.			
Pisidium casertanum				Not on any status lists
Pisidium spp.	Pisidium spp.			
Stagnicola elodes	Marsh Pondsnail			CS
PLANTS				
Downingia pusilla	Dwarf Downingia		Special	CRPR - 2B.2
Legenere limosa	False Venus'-looking-glass		Special	CRPR - 1B.1
Orcuttia tenuis	Slender Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Alnus rhombifolia	White Alder			
Alopecurus saccatus	Pacific Foxtail			
Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Cicendia quadrangularis	Oregon Microcala			
Crassula aquatica	Water Pygmyweed			
Cyperus involucratus	NA			

Downingia bicornuta	NA			
Downingia cuspidata	Toothed Calicoflower			
Downingia ornatissima	NA			
Elatine californica	California Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis quadrangulata	NA			
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium articulatum	Jointed Coyote-thistle			
Eryngium castrense	Great Valley Eryngo			
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Gratiola ebracteata	Bractless Hedge-hyssop			
Gratiola heterosepala	Boggs Lake Hedge-hyssop		Endangered	CRPR - 1B.2
Heteranthera limosa	NA			
Isoetes howellii	NA			
Isoetes nuttallii	NA			
Isoetes orcuttii	NA			
Juncus uncialis	Inch-high Rush			
Juncus usitatus	NA			Not on any status lists
Lasthenia fremontii	Fremont's Goldfields			
Limnanthes alba alba	White Meadowfoam			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Mimulus pilosus				Not on any status lists
Myosurus minimus	NA			
Navarretia heterandra	Tehama Navarretia			
Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Panicum dichotomiflorum	NA			
Persicaria hydropiper	NA			Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Pilularia americana	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys austiniae	Austin's Popcorn-flower			

Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pogogyne zizyphoroides				Not on any status lists
Potamogeton diversifolius	Water-thread Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Psilocarphus tenellus	NA			
Ranunculus bonariensis	NA			
Sagittaria montevidensis calycina				Not on any status lists
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Schoenoplectus mucronatus	NA			
Sidalcea hirsuta	Hairy Checker-mallow			
Veronica anagallis-aquatica	NA			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

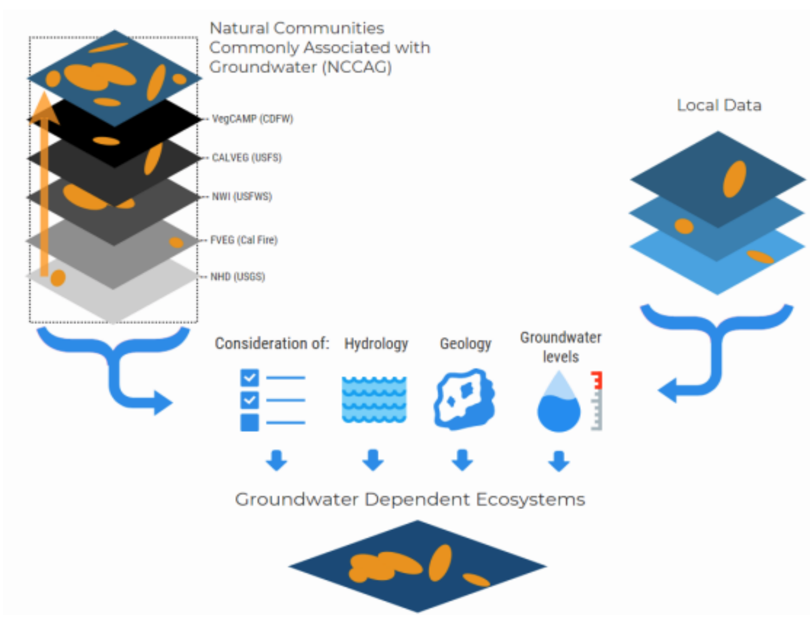


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

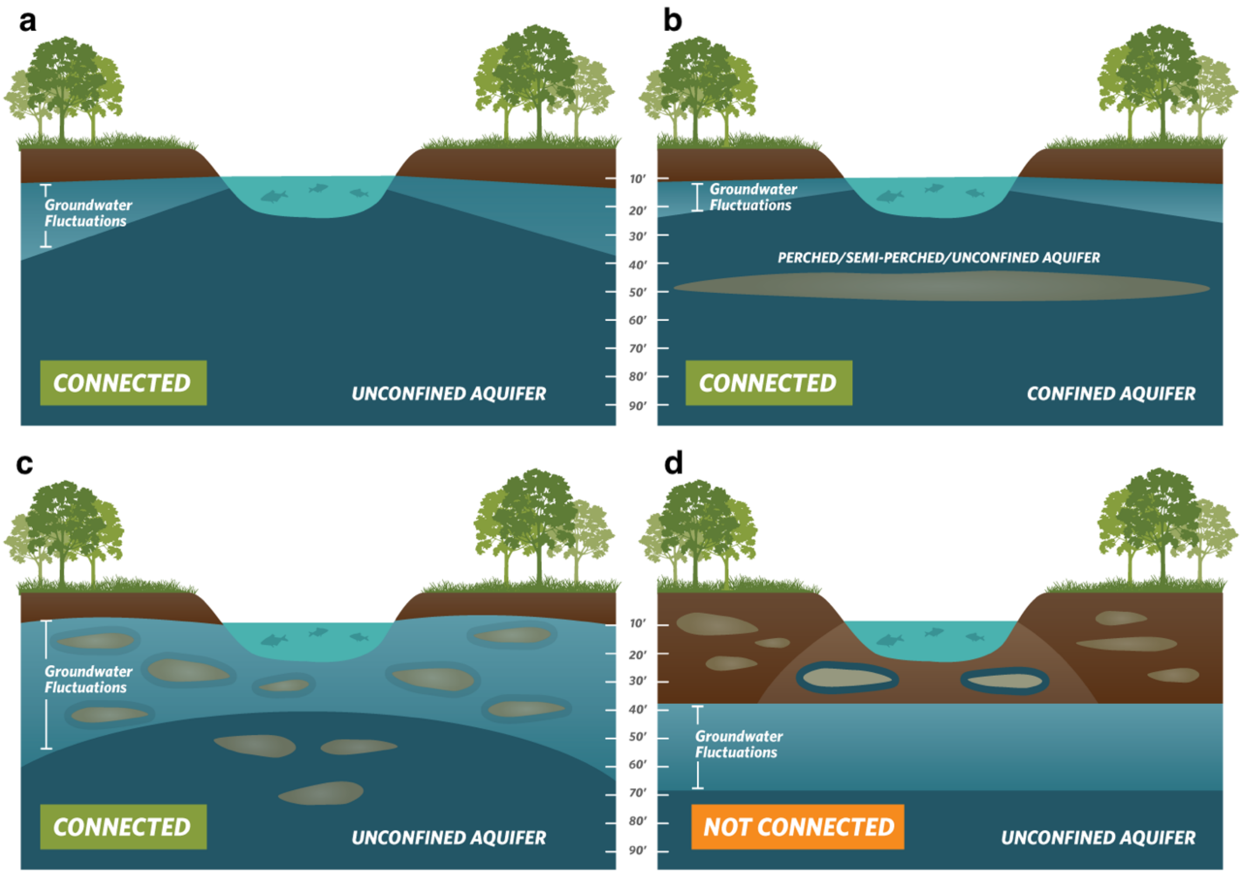


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

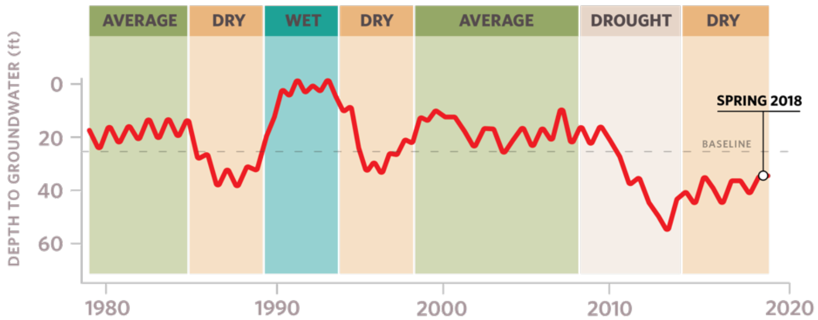


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

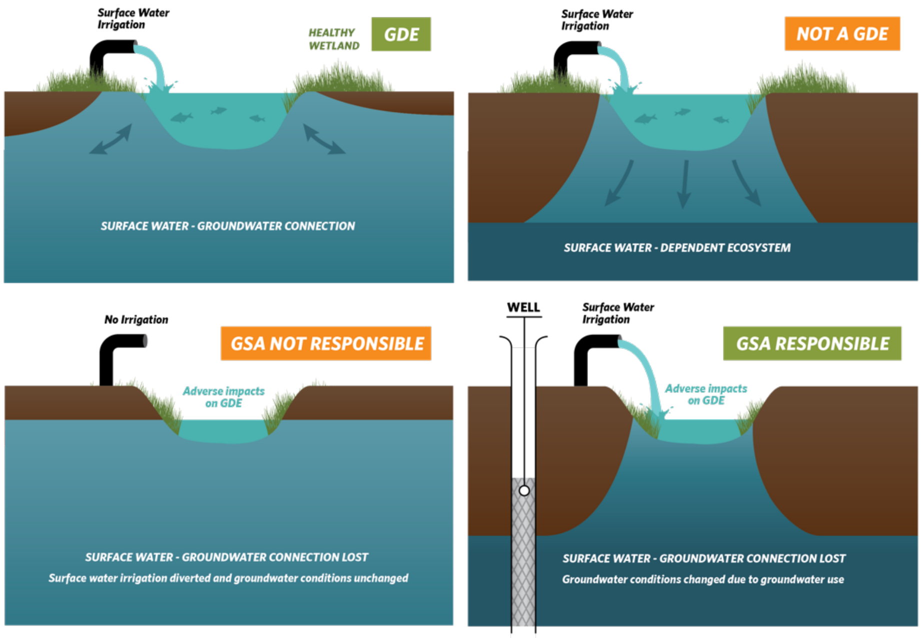


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

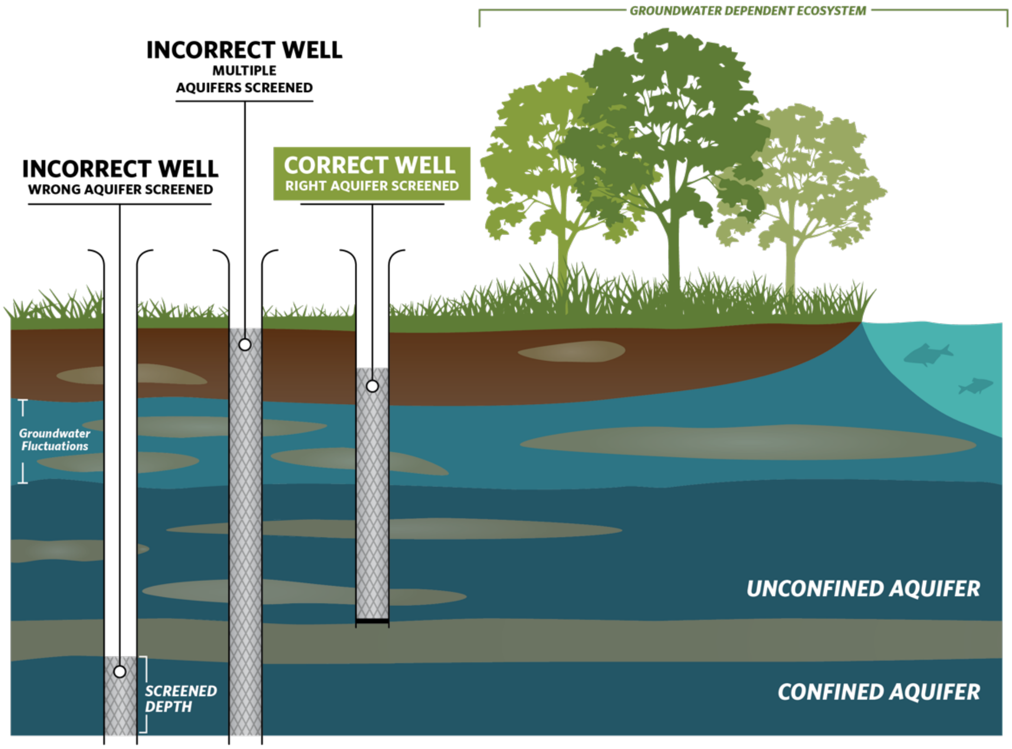

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

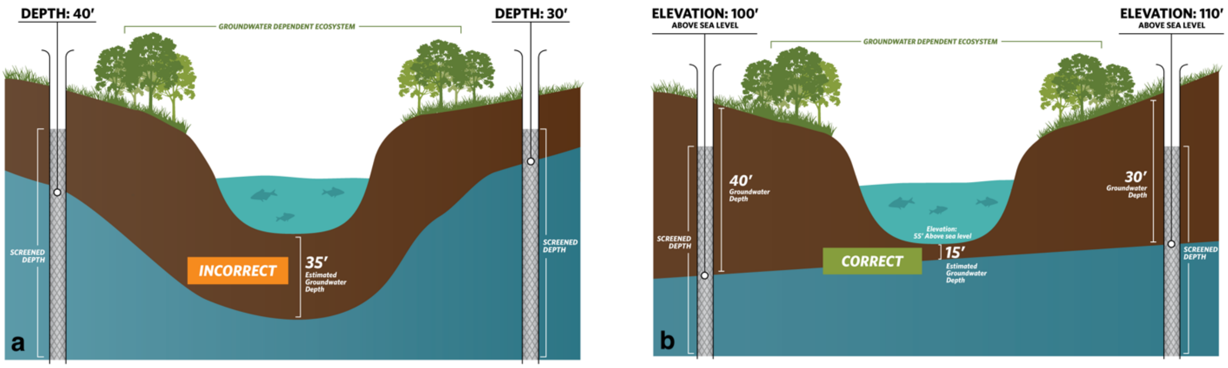

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

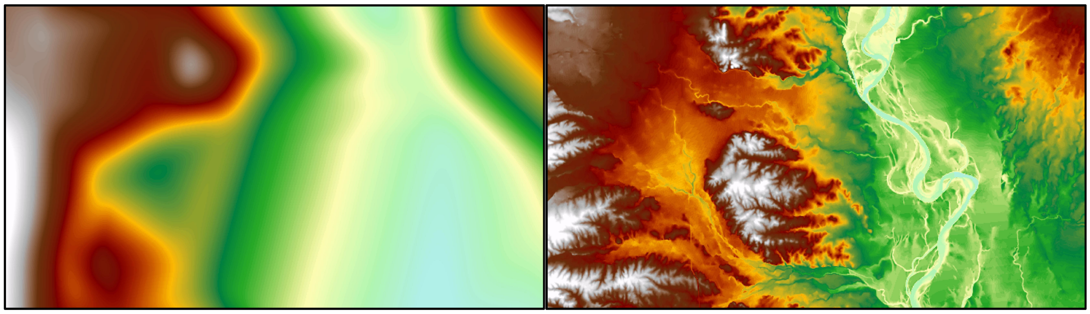

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

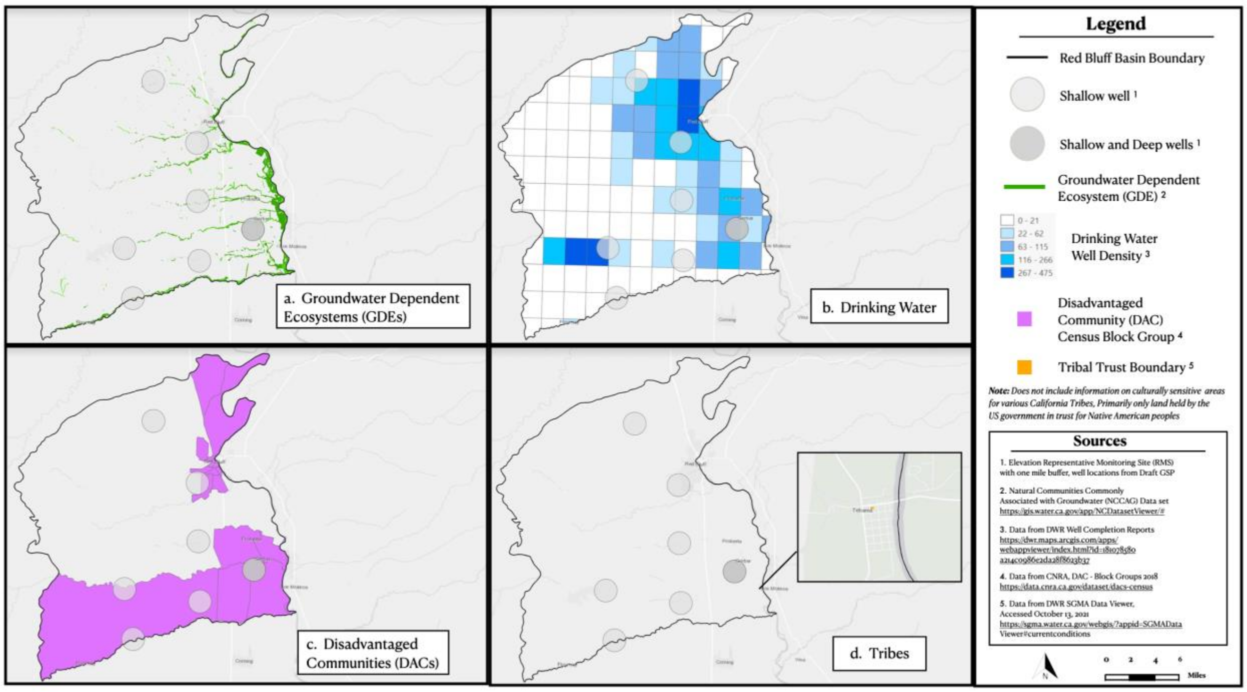

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

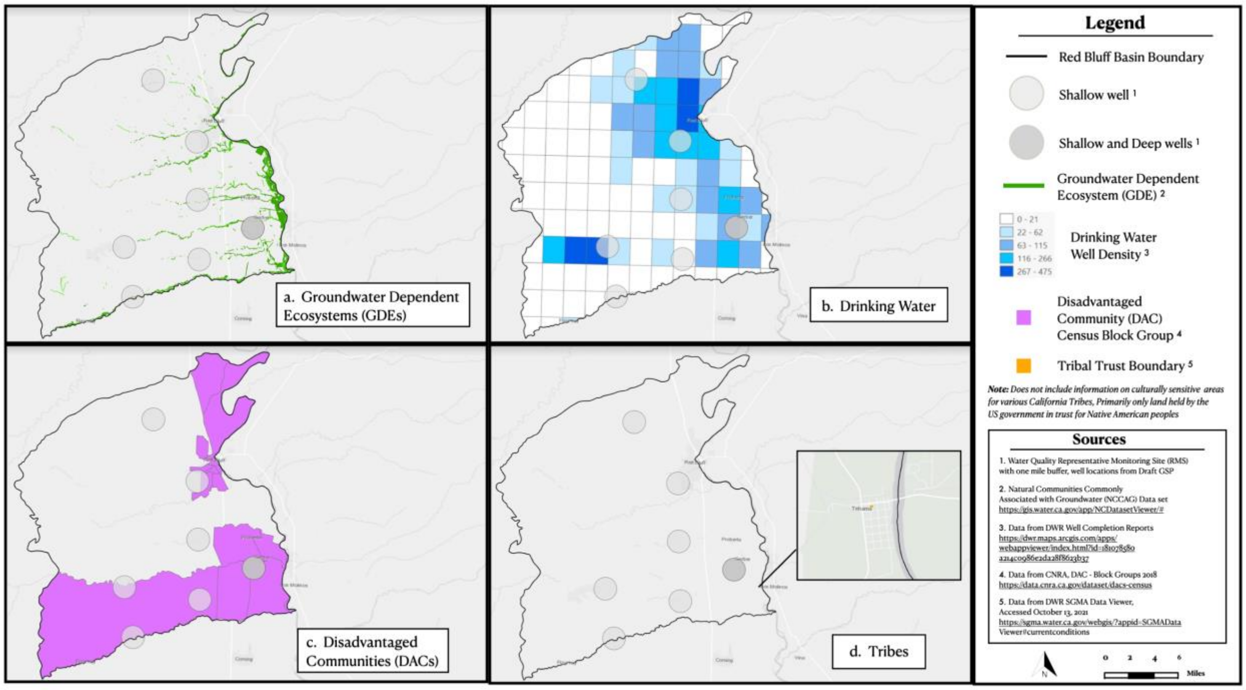

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

October 31, 2021

San Antonio Basin GSA
920 East Stowell Rd
Santa Maria, CA 93454

Submitted via web: https://portal.sanantoniobasingsa.org/comment/new

Re: Public Comment Letter for San Antonio Creek Valley Groundwater Basin Draft GSP

Dear Anna Olsen,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the San Antonio Creek Valley Groundwater Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.

2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to deficiencies of the San Antonio Creek Valley Groundwater Basin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the San Antonio Creek Valley Groundwater Basin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. We note the following deficiencies with the identification of these key beneficial users.

- The GSP fails to identify and map the locations of DACs and describe the size of each DAC population within the basin.
- While the plan provides a density map of domestic wells in the basin (Figure 2-4), the GSP fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the basin.
- The GSP fails to identify the population dependent on groundwater as their source of drinking water in the basin. Specifics are not provided on how much each DAC community relies on a particular water supply (e.g., what percentage is supplied by groundwater).

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Map the locations of DACs and provide the population of each identified DAC. The DWR DAC mapping tool can be used for this purpose.[2] Identify the sources of drinking water for DACs, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

[2] The DWR DAC mapping tool is available online at: https://gis.water.ca.gov/app/dacs/.

- Include a map showing domestic well locations and average well depth across the basin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP presents a conceptual representation of gaining and losing streams (Figure 3-52. Gaining and Losing Streams). The GSP also presents a map (Figure 3-53. Stream Classification) of the basin's stream reaches, as classified by the USGS National Hydrography Dataset (NHD), with labels `Intermittent' and 'Perennial'.

The GSP states (p. 3-102): *"Figure 3-53 is a stream classification map of the Basin as defined by the USGS NHD (USGS, 2020b). Based on the USGS NHD, all the streams in the Basin are classified as intermittent and likely to be losing streams. The stream channels located in Barka Slough are classified as perennial and likely to be gaining streams."* The GSP continues (p. 3-103): *"Interconnected surface water and groundwater within the Paso Robles Formation and Careaga Sand is indicated by the Barka Slough and perennial classification of streams in that area."* With these two statements, the GSP implies that interconnected reaches are defined by perennial conditions. However, this is an incorrect conclusion. Note the regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs. The GSP does not present or analyze depth to groundwater data when identifying ISWs in the basin.

RECOMMENDATIONS

- Provide a map showing all the stream reaches in the basin, with reaches clearly labeled as interconnected or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.

- Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.

- Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, insufficient groundwater data was used to characterize groundwater conditions in the basin's GDEs. The GSP states (3-90): "*Contoured groundwater elevation data for spring 2015 were used to determine areas where the Natural Communities polygons were within 30 feet depth to groundwater. Spring 2015 groundwater elevations were chosen for this analysis because this marked a period of the greatest recent data availability. These data are considered representative of average spring-summer conditions within the last 5 years.*" We recommend using groundwater data from multiple seasons and water year types to determine the range of depth to groundwater around NC dataset polygons. Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying GDEs and is necessary to capture the variability in environmental conditions inherent in California's climate.

We commend the GSA for including an inventory of flora and fauna species in the basin's GDEs. Section 3.2.6.1 presents a discussion of potential GDE vegetation classifications and their acreage, and each of these GDE units is mapped individually on Figure 3-10 (Natural Communities Commonly Associated with Groundwater Dataset). Table 3-9 presents the plants and their rooting depths likely present in Barka Slough. Table 3-12 presents the special-status species that may be located within the basin, which are further discussed in the GSP text and mapped on Figure 3-57 (Special-Status Species Critical Habitat).

Within Section 3.2.6.1 (Identification of Potential GDEs), the GSP states that the maximum rooting depth of Valley Oak (*Quercus lobata*) is 80 feet. However, this deeper rooting depth was not used when verifying whether Valley Oak polygons from the NC Dataset are supported by groundwater. Figure 3-10 shows acreage of Valley Oak polygons across the basin in areas covered by the > 30 ft depth to water area mapped on Figure 3-55. Of the 495 acres of Valley Oak mapped on Figure 3-10, no acreage is retained as a potential GDE in the GSP.

RECOMMENDATIONS

- Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a pre-SGMA baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape. The GSP maps the 30-foot groundwater depth contour on Figure 3-55, showing two areas (<= 30 ft Depth To Water and > 30 ft Depth To Water). However, full depth to groundwater contours are needed to evaluate the valley oak NC dataset polygons.

- Re-evaluate the 495 acres of valley oak present in the basin. Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as valley oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[3,4] The integration of native vegetation into the water budget is **sufficient**. We commend the GSA for including the groundwater demands of this ecosystem in the historical, current and projected water budgets. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATION

- State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Communication and Engagement Plan (Appendix C).[5]

[3] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[4] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[5] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

The Communication and Engagement Plan describes engagement with environmental stakeholders during the GSP development process through the inclusion of an environmental representative on the GSA Advisory Committee. However, we note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement are described in very general terms. They include public notices, meetings, and workshops. No specific outreach was described for DACs and drinking water users. DACs were mentioned once in the initial list of stakeholders and interested parties within the basin, but were not otherwise mentioned in the GSP.

- The plan does not include a plan for continual opportunities for engagement through the *implementation* phase of the GSP for any stakeholders, including DACs, domestic well owners, and environmental stakeholders.

RECOMMENDATIONS
• In the Communication and Engagement Plan, describe active and targeted outreach to engage DAC members, drinking water users, and environmental stakeholders through the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. • Describe efforts to consult and engage with DACs and domestic well owners within the basin. • Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the basin within the GSP.[6]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[7,8,9]

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[6] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[7] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[8] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[9] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP presents a well impact analysis in Section 3.2.1.3. The GSP states (p. 3-50): *"Fall 2018 groundwater elevations measured in basin monitoring wells were used to assess how many wells have static water levels that are below the top of screen elevation as of that date and how many would be below top of screen if groundwater levels were lower. The results of the analysis presented on Figure 3-23 indicate that groundwater water elevations in fall 2018 were below top of screen in 20 percent of domestic wells and 12 percent of agricultural wells in the Basin."*

Minimum thresholds for groundwater levels are set at 25 feet below fall 2018 water levels. The GSP states (p. 4-15): *"The analysis indicates that water levels declining 25 feet below fall 2018 water levels do not result in a substantial increase in the number of wells affected by this condition. If water levels continue to decline, the analysis indicates well owners could observe some depletion of supply. Based on this analysis, stakeholders in the Basin believe that setting the minimum threshold for water levels at 25 feet below fall 2018 water levels will not result in depletion of supply or undesirable results. Setting the minimum threshold at this level allows time for project and management actions to be implemented before minimum thresholds are reached. The well impact analysis presented in Section 3.2 indicates that the majority of the agricultural and domestic wells can tolerate additional groundwater level decline without experiencing undesirable results."* Despite this well impact analysis, the GSP does not sufficiently describe whether minimum thresholds are consistent with California's Human Right to Water policy and will avoid significant and unreasonable loss of drinking water, especially given the absence of a domestic well mitigation plan in the GSP.[10]

Furthermore, undesirable results are characterized by groundwater levels dropping below the minimum threshold after periods of average and above-average precipitation in 50 percent of representative wells for two consecutive years. Using 50% as the threshold suggests that minimum thresholds reached during dry years or periods of drought will not result in an undesirable result. This is problematic since the GSP is failing to manage the basin in such a way that strives to minimize significant adverse impacts to beneficial users, which are often felt greatest in below-average, dry, and drought years.

In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs when defining undesirable results, nor does it describe how the existing groundwater level minimum thresholds will avoid significant and unreasonable impacts to DACs and domestic well users beyond 2015 and be consistent with Human Right to Water policy.[10]

For degraded water quality, the GSP presents water quality standards for constituents of concern (COCs) in Table 4-3. The GSP establishes minimum thresholds pertaining to salts and nutrients as follows (p. 4-34): *"The WQOs presented in Table 4-3 are the minimum thresholds for TDS, chloride, sulfate, boron, sodium, and nitrate as measured by SWRCB ILRP and DDW programs in 20 percent of wells monitored. In cases where the ambient (prior to January 2015) water quality exceeds the WQO, the minimum threshold concentration is 110 percent of the ambient water quality in 20 percent of the wells."* The GSP does not, however, state which COCs have ambient concentrations that exceed the WQO, or provide a summary table of the resulting minimum thresholds.

The GSP states (p. 4-32): *"No minimum thresholds have been established for contaminants because state regulatory agencies, including the RWQCB and the Department of Toxic Substances Control, have the responsibility and authority to regulate and direct actions that address contamination."* However, SMC should be established for all COCs in the basin that may

[10] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

be impacted by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

The GSP only includes a very general discussion of impacts on drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs or drinking water users when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs or drinking water users.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users and DACs when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users and DACs when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[11]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users and DACs.

- In Table 4-3 (Water Quality Standards for Selected Constituents of Concern), compare WQOs, MCLs, and ambient (prior to January 2015) water quality concentrations. Present the final minimum threshold for each COC.

- Set minimum thresholds and measurable objectives for all water quality constituents within the basin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management. Ensure they align with drinking water standards.[12]

<u>**Groundwater Dependent Ecosystems and Interconnected Surface Waters**</u>

When defining undesirable results for chronic lowering of groundwater levels, the GSP briefly mentions impacts to GDEs in the Barka Slough area. However, these impacts are not described or analyzed. This is problematic because without identifying potential impacts on GDEs, groundwater level minimum thresholds may compromise these environmental beneficial users. Furthermore, our comments above in the GDE section note that insufficient shallow groundwater data was used to verify the NC dataset polygons and deeper rooting depths of valley oak were not considered. After re-analyzing GDEs based on our comments above, consider potential impacts to GDEs for the chronic lowering of groundwater levels sustainability indicator.

The GSP recognizes data gaps with respect to the interconnected surface water SMC. For the Barka Slough area, the GSP states (p. 4-54): *"Without an improved understanding of the slough*

[11] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[12] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

water budget, it is not possible at this time to confidently establish a minimum threshold for depletion of interconnected surface water. Until more is known about the relationship between groundwater and surface water in the vicinity of the Slough and depletion can be quantified and monitored, an interim minimum threshold, based on the best available information, focuses on avoiding depletion and maintaining surface water and groundwater flow entering and leaving the Slough." The minimum threshold is 0.15 cfs of surface water flow measured at the Casmalia stream gage west of the Slough, selected based on the analysis of historical base flow at the Casmalia stream gage (Figure 4-2). However, no analysis or discussion is presented to describe how the SMC will affect GDEs, or the impact of this minimum threshold on GDEs in the basin. Furthermore, the GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the basin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

The GSP also recognizes data gaps with respect to ISW in the Las Flores watershed and northeast of Los Alamos on Price Ranch. The GSP states (p. 4-48): "*Until flow of groundwater is better understood in these areas, meaningful SMCs related to interconnected surface water and supporting associated GDEs cannot be developed. If analysis of these areas indicates interconnected surface water with the Paso Robles Formation or the Careaga Sand, SMCs will be developed pursuant to avoid undesirable results as described below."* As noted above in the ISW section of this letter, the GSP did not utilize groundwater elevation data to identify ISWs in the basin. Therefore, in addition to the data gap areas noted above (i.e., Las Flores watershed and northeast of Los Alamos on Price Ranch), additional analyses may be required to develop depletion of interconnected surface water SMC after further identification of ISWs based on groundwater elevation data.

RECOMMENDATIONS

- Define chronic lowering of groundwater SMC directly for environmental beneficial users of groundwater. When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact on GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the basin.[13] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[14]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the basin are reached.[15] The GSP should confirm that minimum

[13] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[14] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[15] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

thresholds for ISWs avoid adverse impacts on both environmental beneficial users of groundwater and surface water as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,16]

- When establishing SMC for the basin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[17] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[18] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the basin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

The GSP incorporates climate change into key inputs (e.g., precipitation, evapotranspiration, and surface water flow) of the projected water budget. However, while climate change is acknowledged to be a likely influence on future basin yields, the GSP does not provide a sustainable yield based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems and domestic well owners.

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[16] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[17] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[18] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Estimate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, GDEs, and ISWs in the basin.

Figure 5-1 (Groundwater Level Monitoring Network) shows insufficient representation of drinking water users and DACs for groundwater elevation monitoring. Figure 5-4 (Groundwater Quality Monitoring Network) shows sufficient spatial representation of drinking water users and DACs for water quality monitoring, but depth representation cannot be verified. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater (note we were only able to prepare water quality monitoring maps with publicly available information). These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[19]

The GSP provides some discussion of data gaps for GDEs and ISWs in Sections 5.8 (Depletion of Interconnected Surface Water Monitoring Network), Section 5.8.2 (Assessment and Improvement of Monitoring Network), and 6.3 (Tier 1 Management Action 1 – Address Data Gaps), but does not provide specific plans, such as locations or a timeline, to fill the data gaps.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, GDEs, and ISWs to clearly identify monitored areas.
- Increase the number of RMSs in the shallow aquifer across the basin as needed to adequately monitor all groundwater condition indicators across the basin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMSs.

[19] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

- Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient** due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

The GSP fails to include projects and management actions with explicit near-term benefits to the environment. While Section 6.11 documents In Lieu Recharge Projects, they are described as being in the conceptual phase and may be considered by the GSA in the future. The plan includes a municipal well mitigation program. However, the GSP fails to specify the mitigation program's benefits to DACs, if any.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program. The GSP includes a discussion of an offsite well impact mitigation program in Section 6.3, however this program is for municipal wells, not domestic wells. If this program will have benefits to DACs, describe them in detail.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For further guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[20]

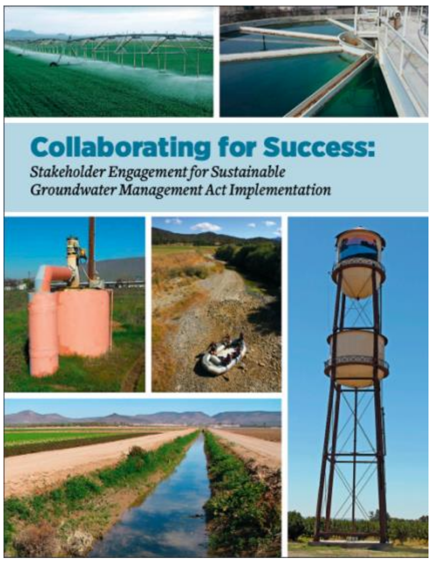
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[20] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

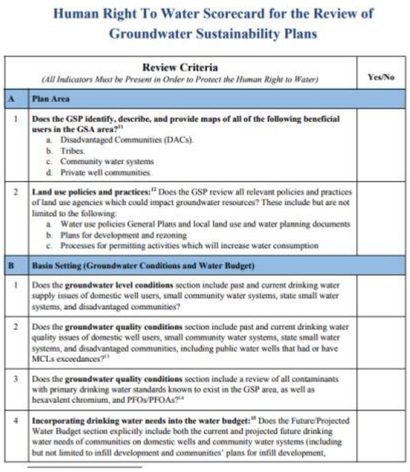
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

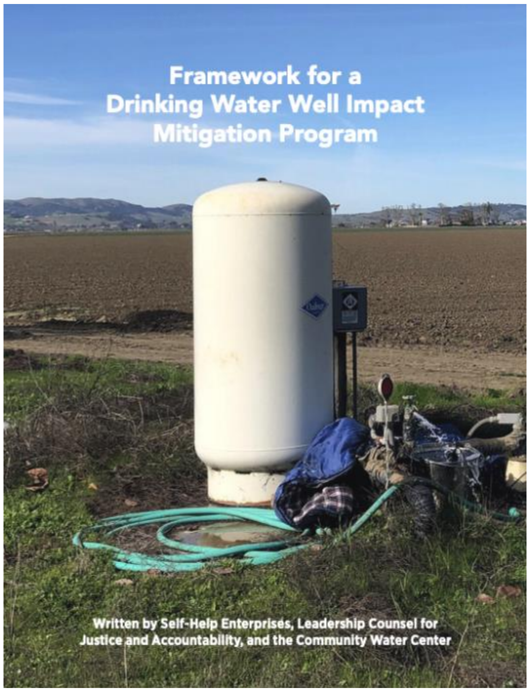
The Human Right to Water


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria (All Indicators Must be Present in Order to Protect the Human Right to Water)	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

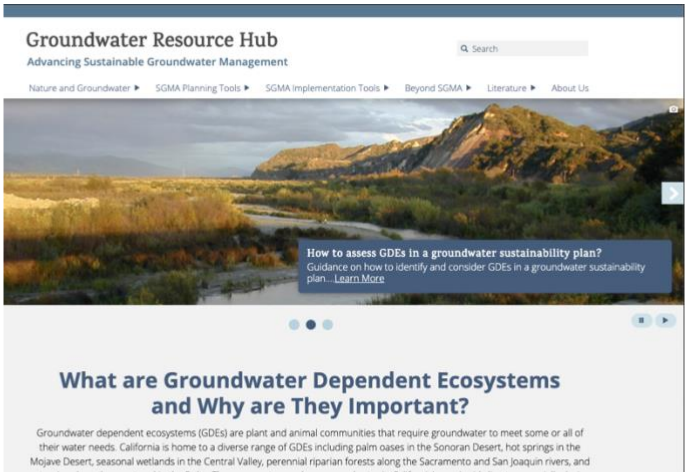
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



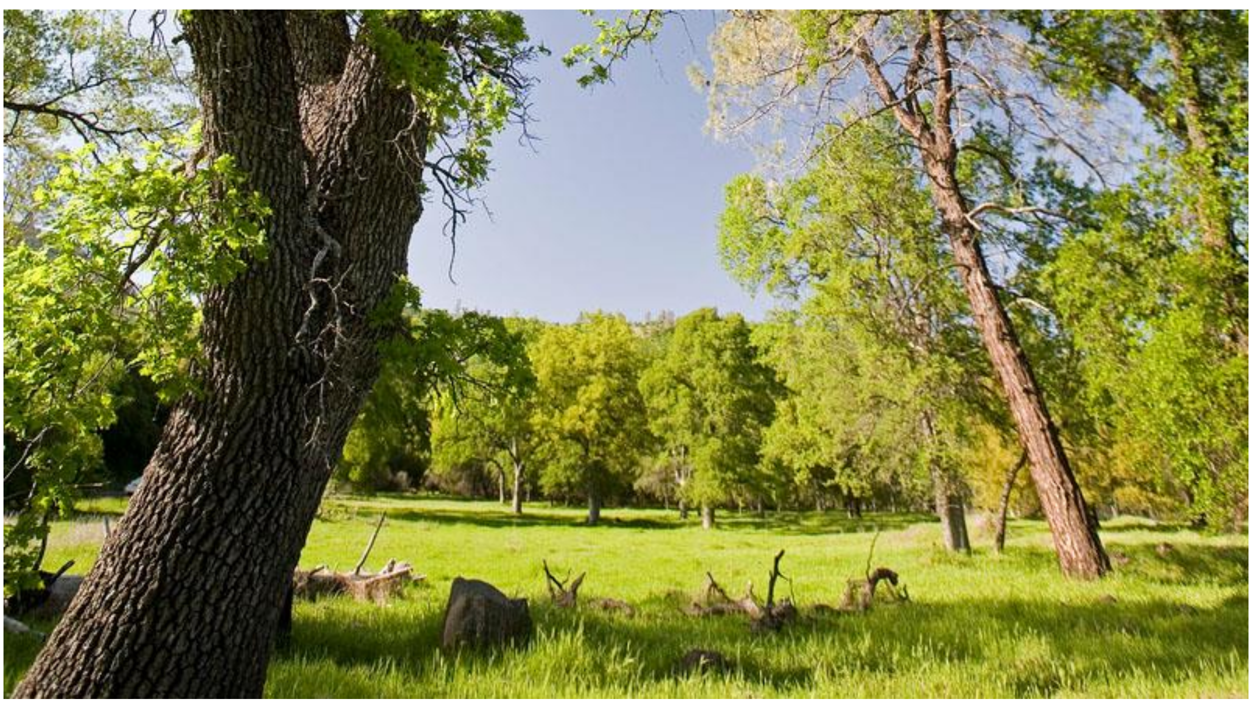
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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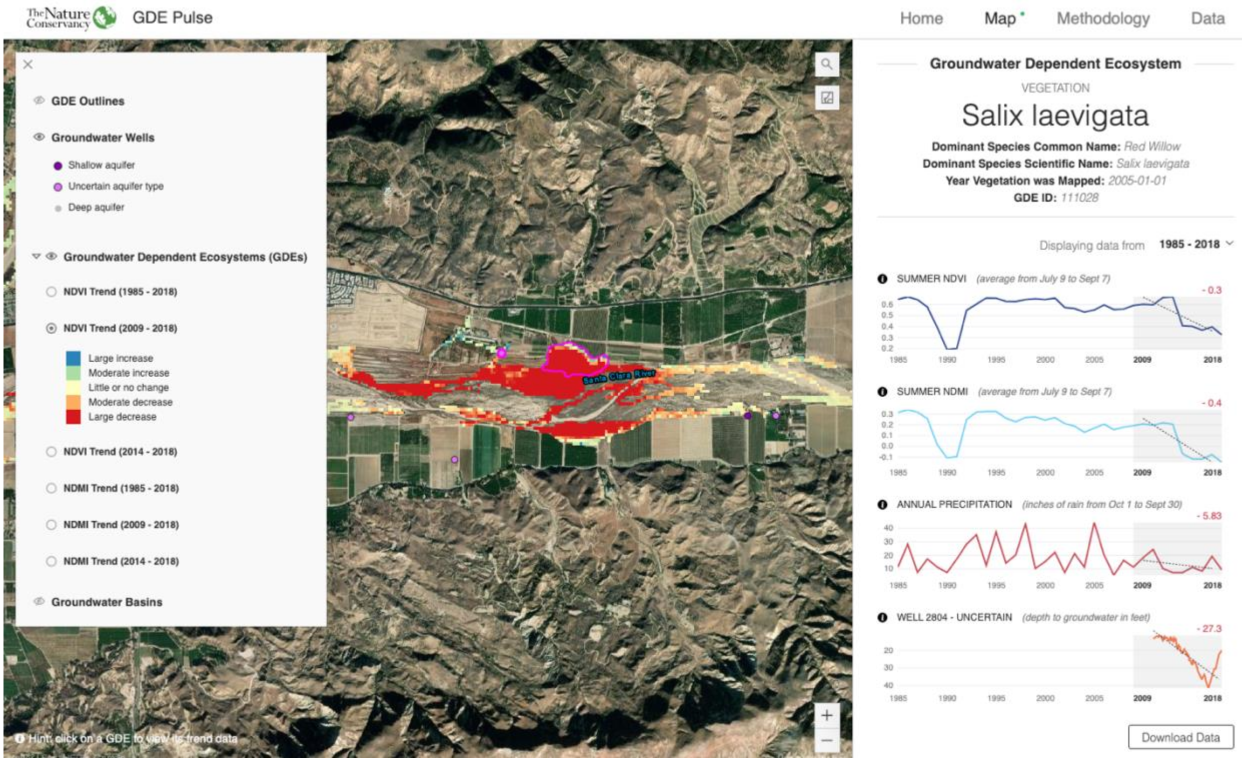
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

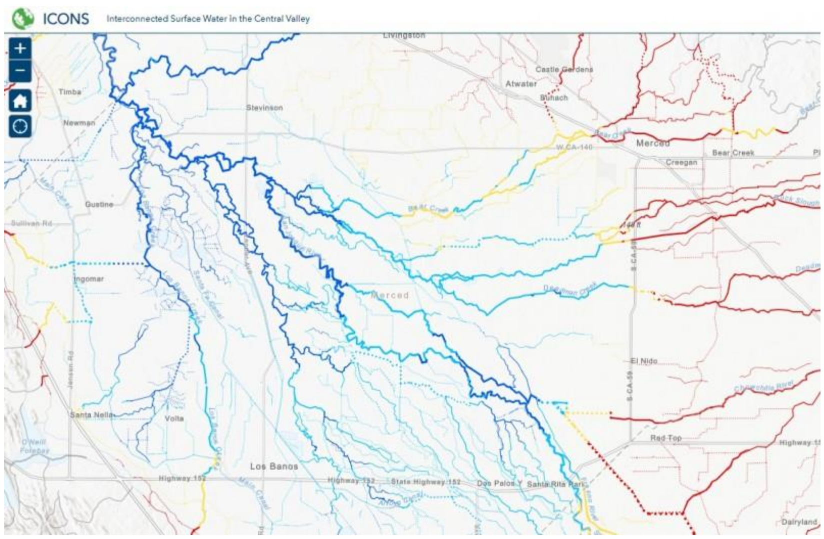
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the San Antonio Creek Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the San Antonio Creek Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas cyanoptera	Cinnamon Teal			
Anas platyrhynchos	Mallard			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Bucephala albeola	Bufflehead			
Calidris minutilla	Least Sandpiper			
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Oxyura jamaicensis	Ruddy Duck			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

CRUSTACEANS				
Cyprididae fam.	Cyprididae fam.			
Hyalella spp.	Hyalella spp.			
FISH				
Gasterosteus aculeatus williamsoni	Unarmored threespine stickleback	Endangered	Endangered	Endangered - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Pseudacris regilla	Northern Pacific Chorus Frog			
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis sirtalis infernalis	California Red-sided Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Acilius abbreviatus				Not on any status lists
Agabus spp.	Agabus spp.			
Apedilum spp.	Apedilum spp.			
Argia nahuana	Aztec Dancer			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetis spp.	Baetis spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Cricotopus spp.	Cricotopus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Dytiscidae fam.	Dytiscidae fam.			

Dytiscus marginicollis				Not on any status lists
Ephydridae fam.	Ephydridae fam.			
Fallceon quilleri	A Mayfly			
Hydrophilidae fam.	Hydrophilidae fam.			
Hydroptila spp.	Hydroptila spp.			
Labrundinia spp.	Labrundinia spp.			
Laccobius spp.	Laccobius spp.			
Limnophyes spp.	Limnophyes spp.			
Optioservus spp.	Optioservus spp.			
Oxyethira spp.	Oxyethira spp.			
Paracladopelma spp.	Paracladopelma spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Peltodytes spp.	Peltodytes spp.			
Psychodidae fam.	Psychodidae fam.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Stictotarsus spp.	Stictotarsus spp.			
Tanytarsus spp.	Tanytarsus spp.			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus spp.	Tropisternus spp.			
MAMMALS				
Ondatra zibethicus	Common Muskrat			Not on any status lists
Castor canadensis	American Beaver			Not on any status lists
MOLLUSKS				
Physa spp.	Physa spp.			
PLANTS				
Alopecurus saccatus	Pacific Foxtail			
Callitriche marginata	Winged Water-starwort			
Cladium californicum	California Sawgrass		Special	CRPR - 2B.2
Eleocharis palustris	Creeping Spikerush			
Eleocharis rostellata	Beaked Spikerush			
Euthamia occidentalis	Western Fragrant Goldenrod			
Helenium puberulum	Rosilla			
Isolepis cernua	Low Bulrush			
Juncus textilis	Basket Rush			
Paspalum distichum	Joint Paspalum			

Persicaria lapathifolia				Not on any status lists
Phacelia distans	NA			
Plagiobothrys undulatus	NA			Not on any status lists
Psilocarphus tenellus	NA			
Salix lasiolepis lasiolepis	Arroyo Willow			
Veronica anagallis-aquatica	NA			
Veronica peregrina	NA			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

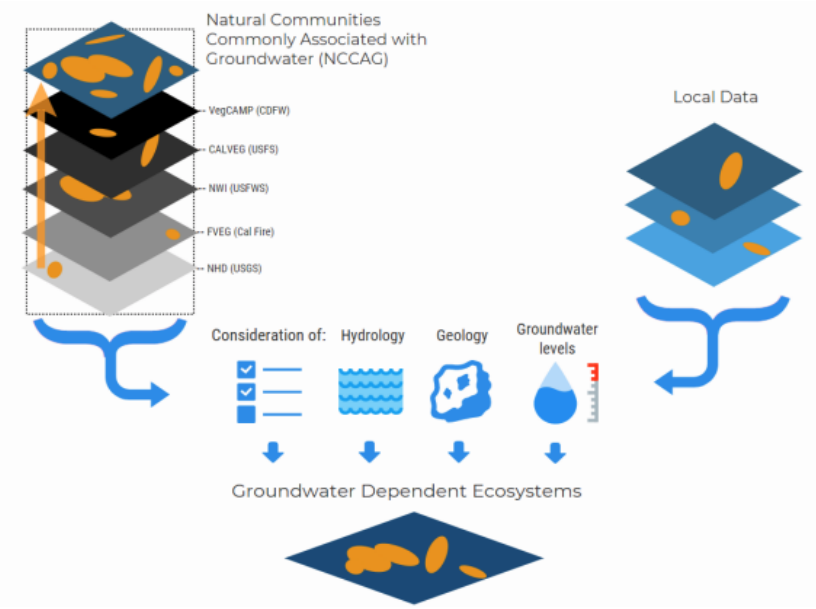


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

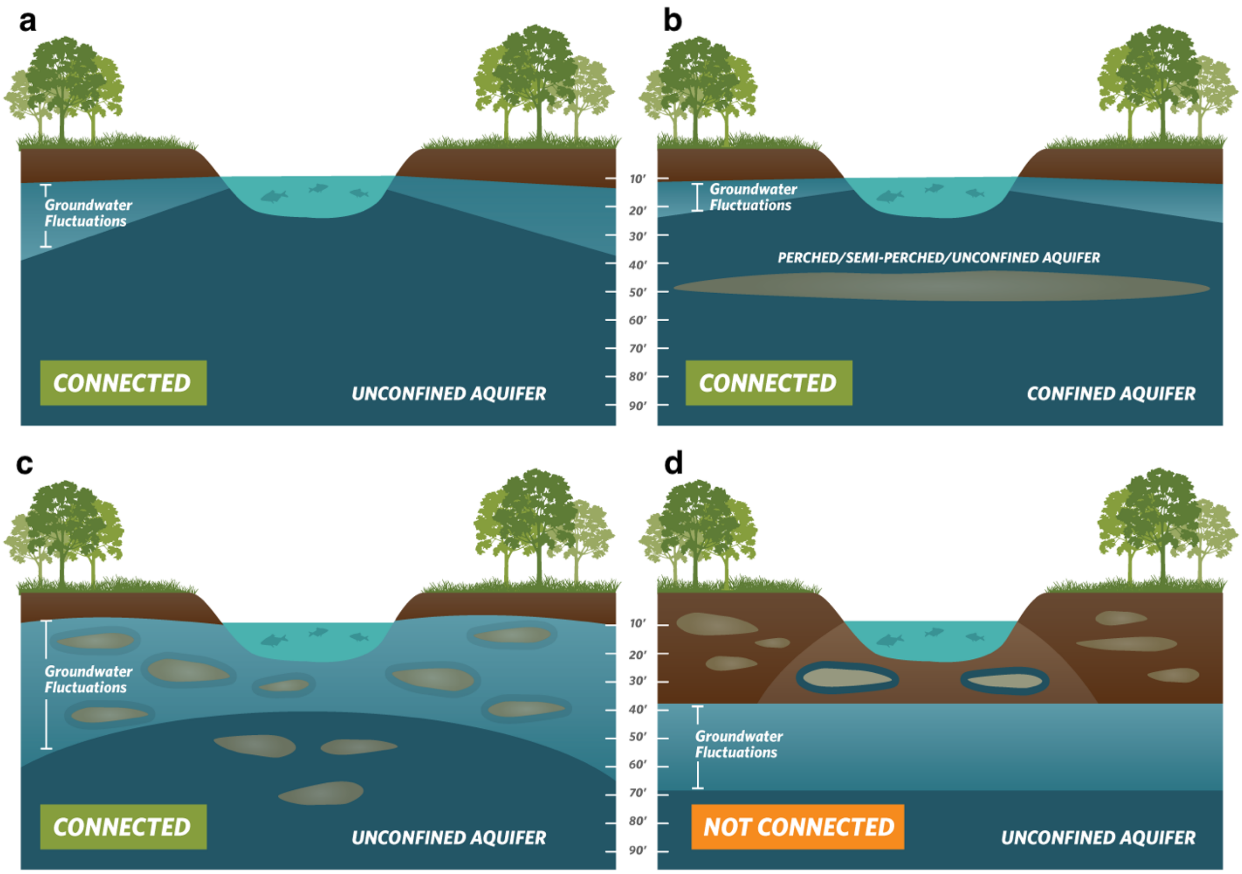


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

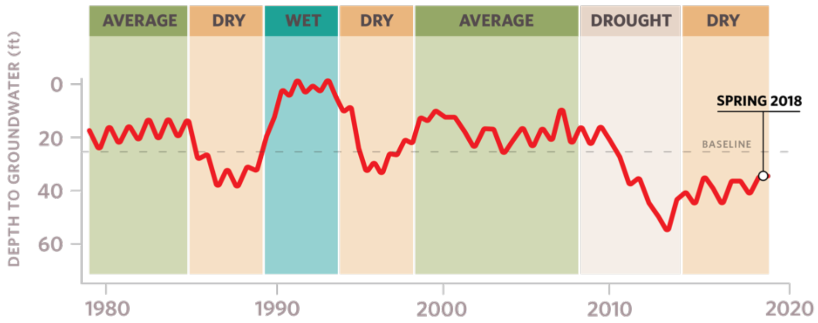


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

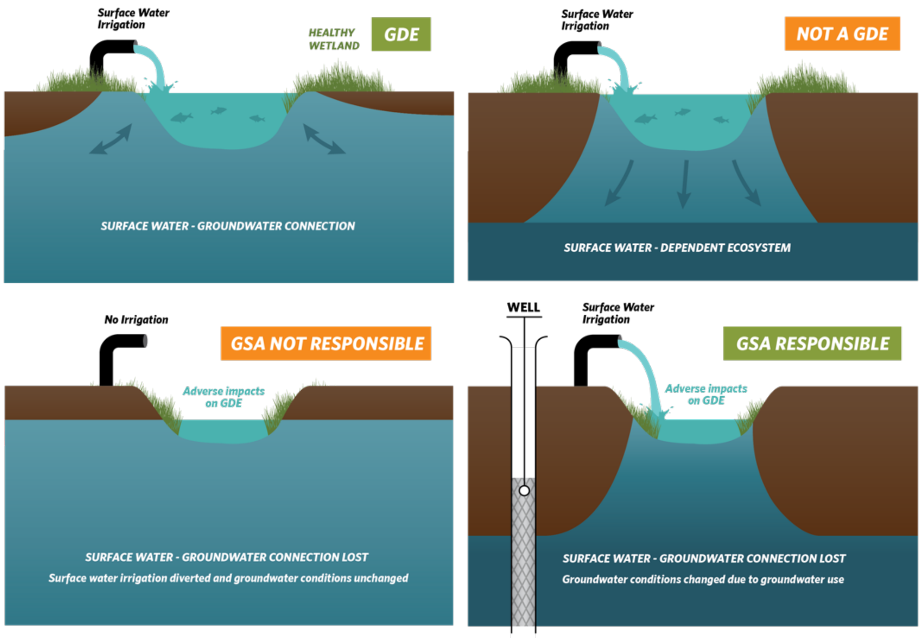

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

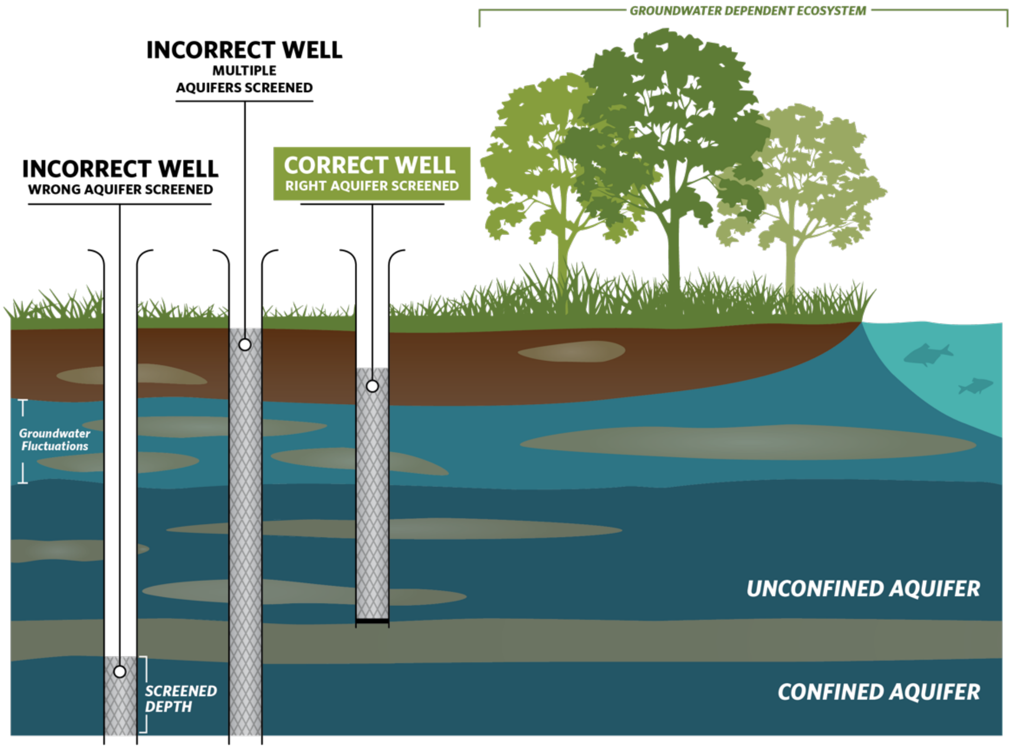

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

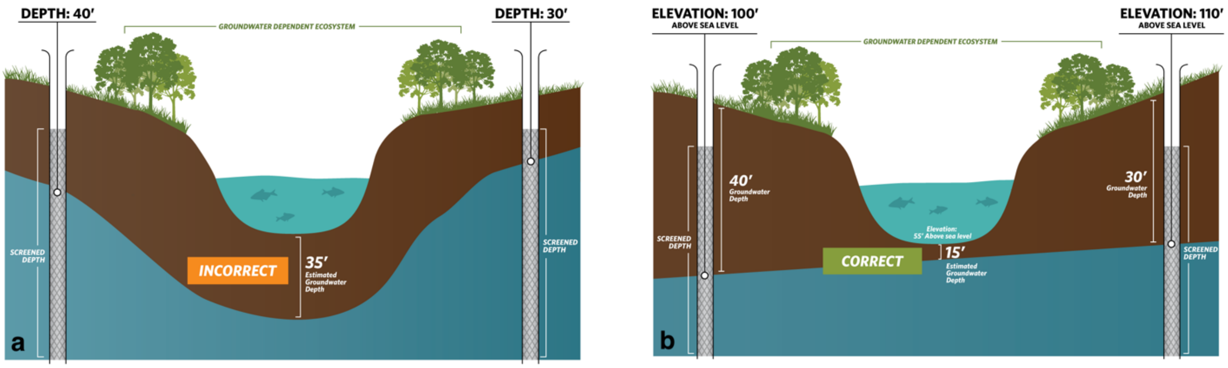

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

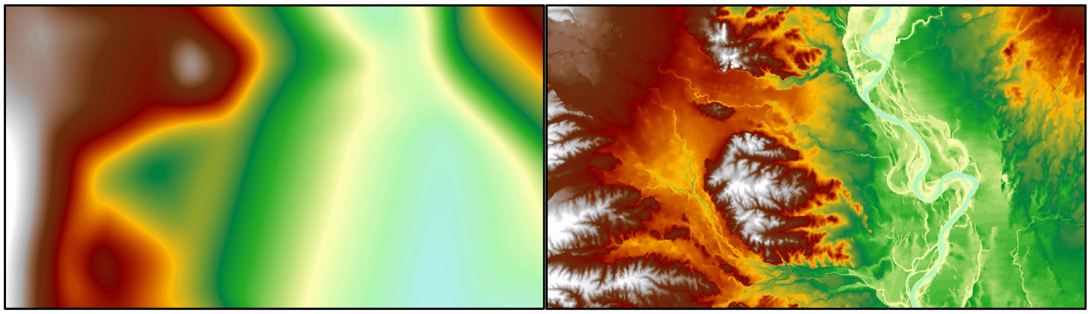

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

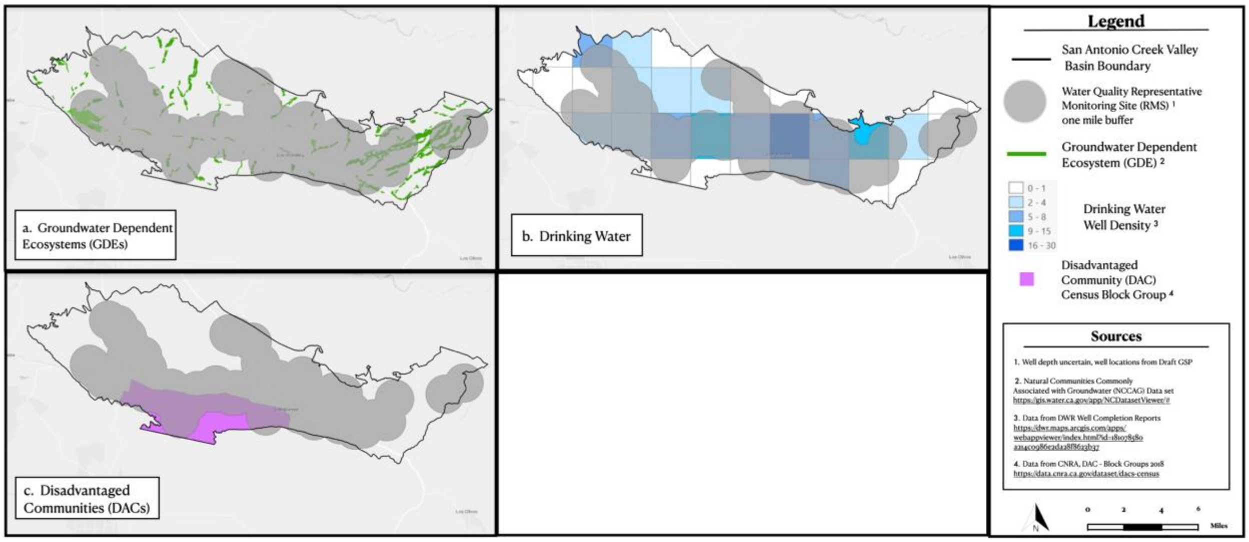

Figure 1. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

November 29, 2021

San Gorgonio Pass Subbasin GSAs
1210 Beaumont Avenue
Beaumont, CA 92223

Submitted via email: leckhart@sgpwa.org

Re: Public Comment Letter for San Gorgonio Pass Subbasin Draft GSP

Dear Lance Eckhart,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the San Gorgonio Pass Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.

2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the San Gorgonio Pass Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the San Gorgonio Pass Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **incomplete**. The GSP maps lands of the Morongo Band of Mission Indians (MBMI), which covers approximately 37 percent of the subbasin's acreage. The GSP provides information on DACs, including identification by name and location on a map. However, the GSP fails to clearly state the population of each DAC or include the population dependent on groundwater as their source of drinking water in the subbasin.

The GSP includes a density map of water wells in the subbasin (Figure 2-8). However, the map groups all wells together and does not differentiate between well types such as domestic, irrigation, or industrial wells. Additionally, the plan fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin. This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the subbasin.

These missing elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide the population of each identified DAC. Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). • Include a domestic well density map for the subbasin.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

- Include a map showing domestic well locations and average well depth across the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP does not provide any analysis of interconnectivity of surface water and groundwater in the subbasin. The GSP states in the Monitoring Network Chapter (p. 5-17): *"Banning Canyon is the only area in the SGP Subbasin that is subject to SGMA with respect to interconnected surface water and has a history of depth to water occurring seasonally at less than 50-feet within the historic period (1998-2019)."* There is no further discussion of the 50-foot screening depth, or any maps provided in the GSP that show depth to groundwater contours, only groundwater elevation contours from spring 1998 (Figure 3-16) and spring 2019 (Figure 3-17).

The GSP states (p. 3-73): *"San Gorgonio River is an interconnected surface water system during high precipitation years; however, these conditions are not consistent throughout the year and are not assured in all years."* Note the regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

The GSP states (p. 3-73): *"Additional ephemeral distributaries from the Whitewater River are present in the Potrero, Hathaway, and Millard Canyons that fall within MBMI lands. These waterways and the downstream uses are confined to MBMI's jurisdiction, which is not subject to SGMA due to the Tribe's federally recognized status."* However, SGMA states that "Federally recognized Indian Tribes...may voluntarily agree to participate in the preparation and administration of a groundwater sustainability plan" [Water Code §10720.3(c)]. Finally, SGMA defines the California Native American Tribes as beneficial users of groundwater [Water Code §10723.2(h)]. Please include information on what steps were taken to address these requirements.

The GSP states (p. 3-73): *"A depiction of all waterways, including ephemeral systems, are included in Figure 3-52 below."* Figure 3-52 is captioned "Interconnected Surface Water Features in the SGP Subbasin" but no descriptive labels are provided on this figure, including which stream reaches are considered interconnected or disconnected.

RECOMMENDATIONS

- On the map of streams in the subbasin (Figure 3-52), clearly label reaches as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.

- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.

- Overlay the subbasin's stream reaches on depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used to create the maps.

- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

- Provide further information about the steps taken to involve or collaborate with the MBMI regarding ISWs located within the subbasin.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of comprehensive, systematic analysis of the subbasin's GDEs.

The GSP states (p. 3-75): *"Depth to groundwater was the primary metric for identifying potential GDEs in the Subbasin. TNC's GDE Pulse interactive mapping tool was used in conjunction with long-term groundwater level data, hydrogeologic cross-sections, and historic aerial imagery to analyze the potential for GDE presence."* The GSP discusses depth to water in general terms, but does not provide depth-to-water contours, only groundwater elevation contours for spring 1998 (Figure 3-16) and spring 2019 (Figure 3-17). There is no further discussion of the use of hydrogeologic cross-sections or historic aerial imagery.

Figure 3-53 provides a map of potential GDEs in the subbasin, along with areas marked as depth to groundwater > 200 feet. The text does not state how the GDE mapping was conducted, nor do any figures show depth-to-groundwater contours for depths other than 200 feet.

The GSP states (p. 3-75): *"MBMI lands are not subject to SGMA, and data are not generally available in those areas for full identification as GDEs. These areas have been identified as a data gap. To be conservative, these canyons are identified as potential GDE areas."* As stated above under the ISW section, provide further information about the steps taken to involve or collaborate with the MBMI regarding GDEs located within the subbasin.

RECOMMENDATIONS

- Develop and describe a systematic approach for analyzing the subbasin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained or removed from the NC dataset (and the removal reason if polygons are not considered potential GDEs). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- Provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin and note any threatened or endangered species (see Attachment C in this letter for a list of freshwater species located in the San Gorgonio Pass Subbasin).

- Provide further information about the steps taken to involve or collaborate with the MBMI regarding GDEs located within the subbasin.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of native vegetation into the water budget is **insufficient**. The water budget did not include the current, historical, and projected demands of native vegetation. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the subbasin.

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.

- State whether or not there are managed wetlands in the subbasin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Communication & Outreach Plan (Section 2.5).[4]

The GSP discusses engagement with the MBMI through the GSP development process. The plan has emphasized a commitment to collaboration with MBMI to meet the subbasin's sustainability goals. The plan also highlights how stakeholder input was incorporated into the GSP development process.

However, we note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement in general terms, including standing member agency board meetings, Stakeholder Advisory Group meetings, and the 60-day period to review the Public Draft GSP and provide comments. The plan lacks specific details of outreach and engagement targeted to DACs, domestic well owners, and environmental stakeholders during the GSP development process.

- The GSP fails to include opportunities for engagement through the *implementation* phase of the GSP that is specifically directed to DACs, domestic well owners, tribes, and environmental stakeholders.

RECOMMENDATIONS

- Clearly identify which stakeholders members of the Stakeholder Advisory Group represent (e.g., DACs, environmental, tribal) and how their input was incorporated into the GSP.

- In the Communication & Outreach Plan, describe active and targeted outreach to engage all stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the subbasin.[5]

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

Minimum thresholds for chronic lowering of groundwater levels were developed using an iterative process that used groundwater model projections and historical water level data. Minimum thresholds for some wells were set to meet the production demands of Mission Springs Water District (MSWD). For other wells, the GSP states (4-22): *"Initially, groundwater levels were projected using the groundwater model under current conditions for the long-term hydrologic period. These projected water levels were then compared to well construction characteristics at representative monitoring wells and other known nearby production wells to identify the level of impacts. Where the groundwater level projections did not result in significant and unreasonable impacts to known beneficial uses (production for the domestic, commercial, municipal, and industrial uses), the minimum threshold was set to the lowest level of the projections for wells 18A1 COB M11, 11H3, and 7P4. Where significant and unreasonable impacts to beneficial uses were identified in the projections (such as water levels falling below pump settings or well depth), the minimum thresholds were revised upward to levels that would avoid those impacts."* This is the only discussion related to well impacts, and no further details are provided on the impacts to domestic wells. Therefore, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold, and whether the undesirable results are consistent with the Human Right to Water policy,[9] especially given the absence of a domestic well mitigation plan in the GSP. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs, domestic well owners, or tribes when defining undesirable results, nor does it describe how the groundwater level minimum thresholds are consistent with Human Right to Water policy and will avoid significant and unreasonable impacts on these beneficial users.

Undesirable results are established as two of the six representative water level monitoring wells exceeding their minimum threshold in a 5-year period. The GSP states (p. 4-5): *"Two wells are selected to ensure isolated anomalies related to well monitoring or construction failures in one well are not misconstrued to represent the entire Subbasin. The 5-year period is defined as an appropriate period to assess exceedances because it allows enough time for groundwater levels to rebound or be adaptively managed following a single or few years critical period and because it corresponds with the 5-year GSP Update periods."* This implies that significant and unreasonable impacts to beneficial users experienced during dry years or periods of drought will not result in an undesirable result. This is problematic given that a 5-year period is sufficient time frame for drinking water wells to go dry and thus the GSP is failing to manage the subbasin in such a way that strives to minimize significant adverse impacts to beneficial users, which are often felt greatest in below-average, dry, and drought years.

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[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

Minimum thresholds for groundwater quality are set to the maximum contaminant level (MCL) for nitrate of 10 mg/L and the secondary MCL (SMCL) of 1,000 mg/L for TDS. In each case, the measurable objective is defined as 80 percent of the minimum threshold which is a significant trigger level for drinking water users. According to the state's anti-degradation policy,[10] high water quality should be protected and is only allowed to worsen to the MCL if a finding is made that it is in the best interest of the people of the State of California. No analysis has been done and no such finding has been made. Also, Section 3.2.4 of the GSP (Groundwater Quality Issues) presents water quality data and discusses trends for several other naturally occurring water quality constituents (arsenic, iron, chromium-6, manganese, and fluoride) that have exceeded regulatory standards. No SMC have been established for these additional constituents, however. SMC should be established for all COCs in the subbasin impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.
- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users, DACs, and tribes within the subbasin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be fully or partially de-watered at the minimum threshold.
- Consider minimum threshold exceedances during drought years when defining the groundwater level undesirable result across the subbasin.

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality.[11] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[12]
- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.
- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management.

[10] Anti-degradation Policy https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf

[11] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[12] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

- Set minimum thresholds that do not allow water quality to degrade to levels at or above the MCL trigger level.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria are established for chronic lowering of groundwater levels at three wells in the Banning Canyon area, where the GSP has determined GDEs are a beneficial user of groundwater (Table 4-6). Sustainable management criteria for depletion of interconnected surface water are established by proxy using groundwater elevations at these same three wells.

The minimum thresholds at wells located in Banning Canyon were established as follows (p. 4-18): *"The minimum threshold was assigned at the point in which groundwater extractions from the Banning Canyon Storage Unit typically halt and the City of Banning converts to pumping in the Banning Storage Unit to supply the needs of the city. This minimum threshold was defined to maintain the status quo, which has not caused undesirable results related to interconnected surface water."* Hydrographs of groundwater elevations at these wells show that the minimum thresholds are set to elevations at or below historic groundwater elevations. For discussion of impacts on GDEs, the GSP states (p 4-10): "*To consider the interests of the beneficial use of groundwater by GDEs, the historic canyon groundwater elevation and extraction data were compared to historic GDE footprints documented by TNC's GDE Pulse, which confirmed there were no undesirable results because of groundwater management during the most significant drought periods."* The GSP states (p. 4-6): *"Undesirable Result No. 3. is defined as two of the three Banning Canyon representative water level/interconnected surface water monitoring sites experiencing minimum threshold exceedances for five consecutive years."* However, if minimum thresholds are set to levels lower than historic low groundwater levels and the subbasin is allowed to operate at or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse.

No analysis or discussion is presented to describe how the SMC will affect beneficial users, and more specifically GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the

subbasin.[13] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[14]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[15] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,16]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[17] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[18] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios

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13 "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

14 The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

15 "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

16 Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

17 "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

18 Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP integrates climate change into key inputs (e.g., changes in precipitation and surface water flows) of the projected water budget. Although the GSP states that evapotranspiration is adjusted for climate change, inputs are not included in the budget tables or figures for the historic, current, and projected water budgets, making the quantified changes on this input unclear. Furthermore, the sustainable yield is not calculated based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extreme climate scenarios and sustainable yield not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, tribes, and domestic well owners.

RECOMMENDATIONS

- Present evapotranspiration inputs in the tables and figures for the historic, current, and projected water budgets. Estimate the amount of change in evapotranspiration due to climate change.
- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions around GDEs and ISWs in the subbasin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[19]

Figure 5-1 (Representative Water Level Monitoring Network) shows sufficient spatial representation of DACs and drinking water users for groundwater elevation monitoring, however depth representation cannot be determined from the information provided in the GSP. Likewise, Figure 5-2 (Representative Groundwater Quality Monitoring Network) shows sufficient spatial representation of DACs and drinking water users for water quality monitoring, however depth representation cannot be determined from the information provided in the GSP.

[19] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

We cannot assess the monitoring network on federal MBMI lands with the information presented in the GSP. The GSP states (p. 5-25): "*The MBMI lands are not subjected to SGMA, as MBMI is a federally recognized tribe. Over 36,000 acres of the Subbasin fall within MBMI's jurisdiction. It is within MBMI's right to keep water level and other data private. Therefore, this area is considered a permanent data gap in the SGP Subbasin."* Furthermore, the GSP states (p. 6-25): *"MBMI representatives have voluntarily participated in the GSP Working Group supporting the development of the SGP GSP, but MBMI has elected to not submit data and water use information to the GSAs for inclusion in the GSP."*

The GSP does not discuss data gaps for GDEs and ISWs, other than the data gap for GDEs on MBMI land. Proposed future water level monitoring site locations are shown on Figure 5-4, however the locations do not appear to be prioritized for GDE or ISW monitoring.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify monitored areas.
- Increase the number of RMSs in the shallow aquifer across the subbasin as needed to map ISWs and adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMSs.
- Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.
- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, drinking water users, and tribes. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

While the GSP describes groundwater recharge projects such as Project #2 (Stormwater Capture) and Project #3 (Additional imported Water Spreading at Noble Creek Spreading Basins), it fails to describe the projects' explicit benefits or impacts to key beneficial users, such as the environment and DACs. The GSP also fails to include a domestic well impact mitigation program to avoid significant and unreasonable loss of drinking water.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSAs plan to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[20]

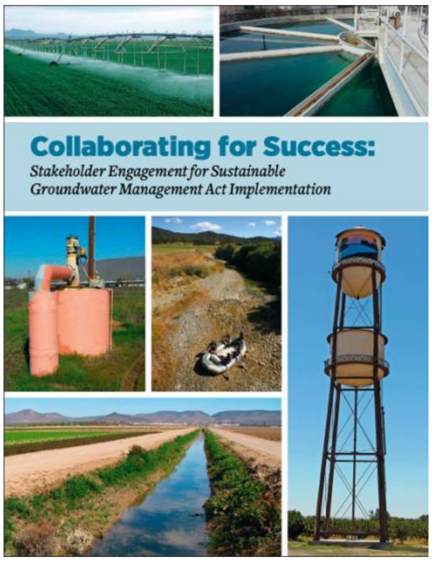
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[20] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



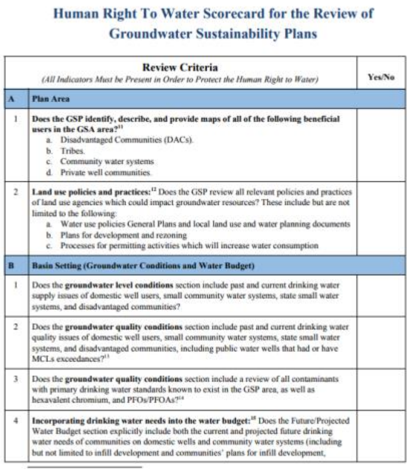
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

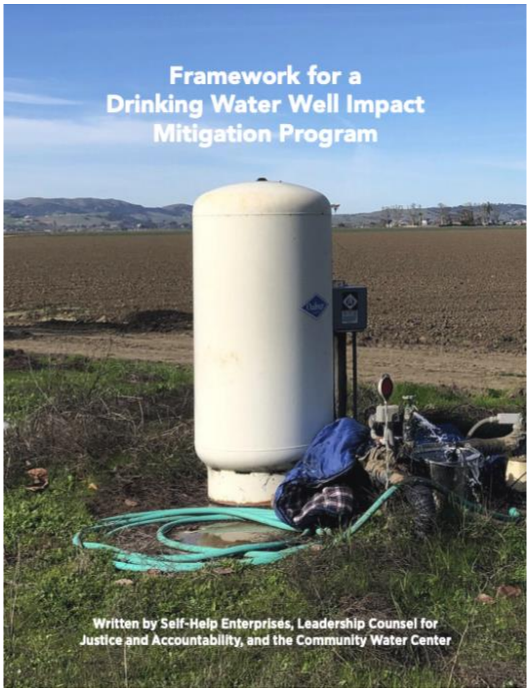


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

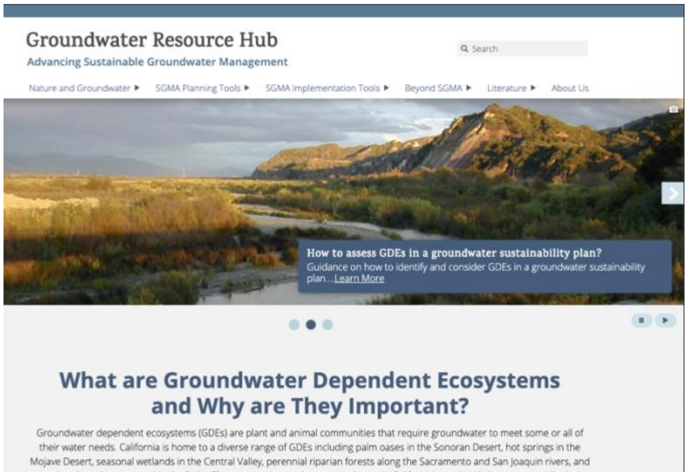
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The [Plant Rooting Depth Database]() provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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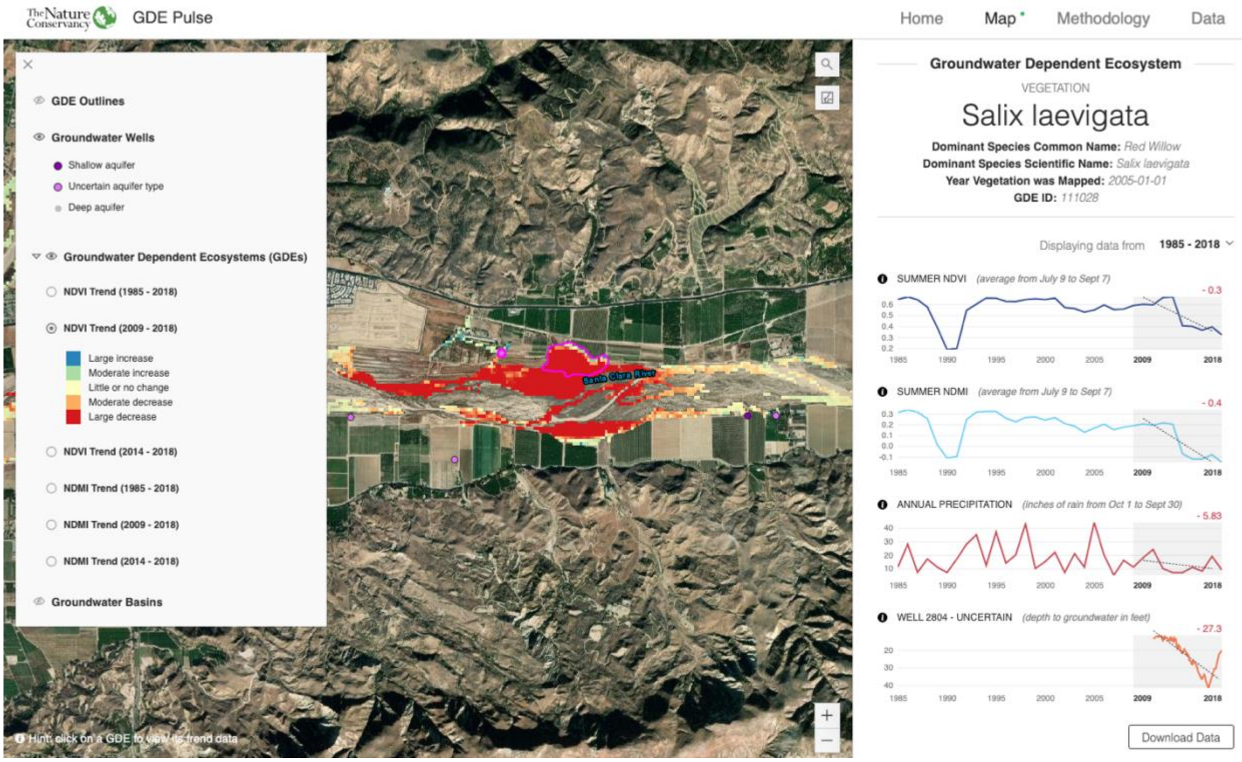
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

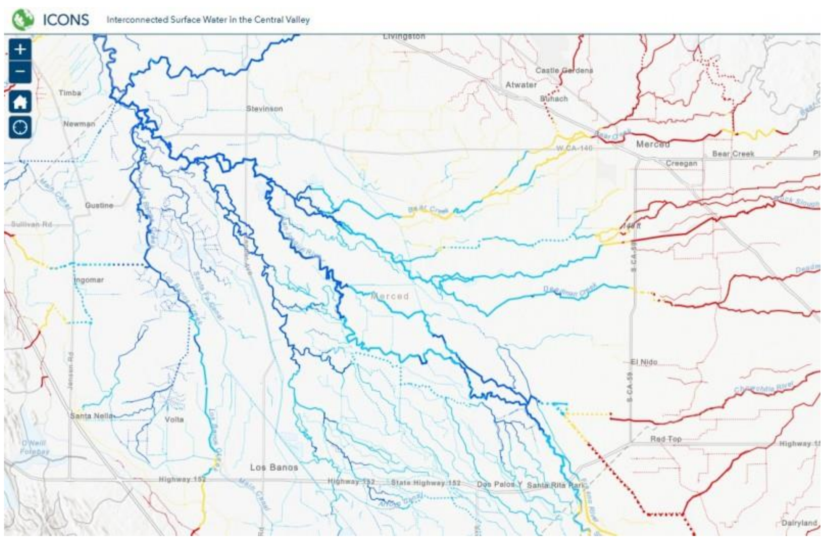
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data [available online](#) from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the San Gorgonio Pass Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the San Gorgonio Pass Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Anas platyrhynchos	Mallard			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Megaceryle alcyon	Belted Kingfisher			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern	ARSSC
Anaxyrus punctatus	Red-spotted Toad			
Pseudacris cadaverina	California Treefrog			ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Rana muscosa	Southern Mountain Yellow-legged Frog	Endangered	Candidate Endangered	ARSSC

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Anaxyrus boreas halophilus	California Toad			ARSSC
INSECTS & OTHER INVERTS				
Capnia teresa	Bernardino Snowfly			
Enochrus carinatus				Not on any status lists
Enochrus piceus				Not on any status lists
Sympetrum corruptum	Variegated Meadowhawk			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
MOLLUSKS				
Gyraulus vermicularis	Pacific Coast Gyraulus			CS
PLANTS				
Alnus rhombifolia	White Alder			
Baccharis salicina				Not on any status lists
Castilleja minor minor	Alkali Indian-paintbrush			
Eleocharis montevidensis	Sand Spikerush			
Eleocharis parishii	Parish's Spikerush			
Hydrocotyle ranunculoides	Floating Marsh-pennywort			
Hydrocotyle umbellata	Many-flower Marsh-pennywort			
Juncus textilis	Basket Rush			
Juncus xiphioides	Iris-leaf Rush			
Lythrum californicum	California Loosestrife			
Mimulus guttatus	Common Large Monkeyflower			
Mimulus pilosus				Not on any status lists
Phacelia distans	NA			
Pluchea sericea	Arrow-weed			
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			

Salix lasiolepis lasiolepis	Arroyo Willow			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

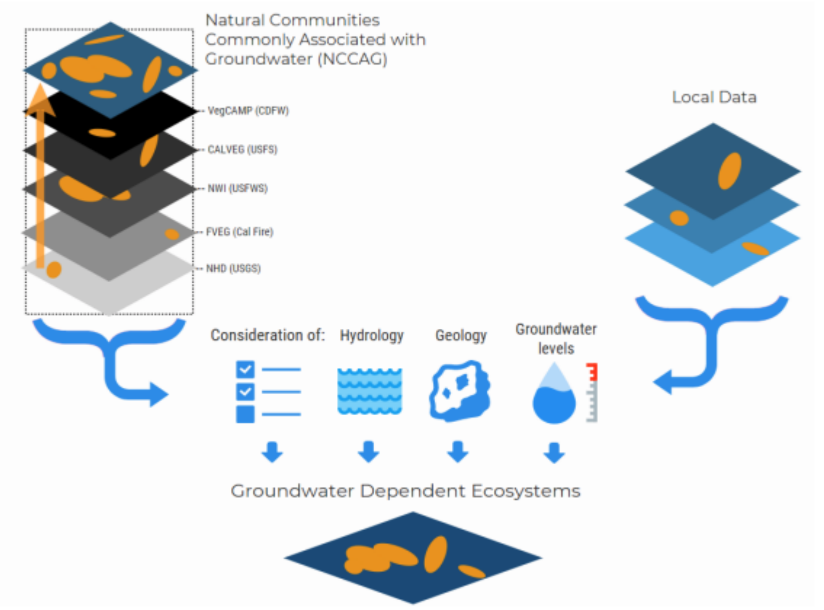


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

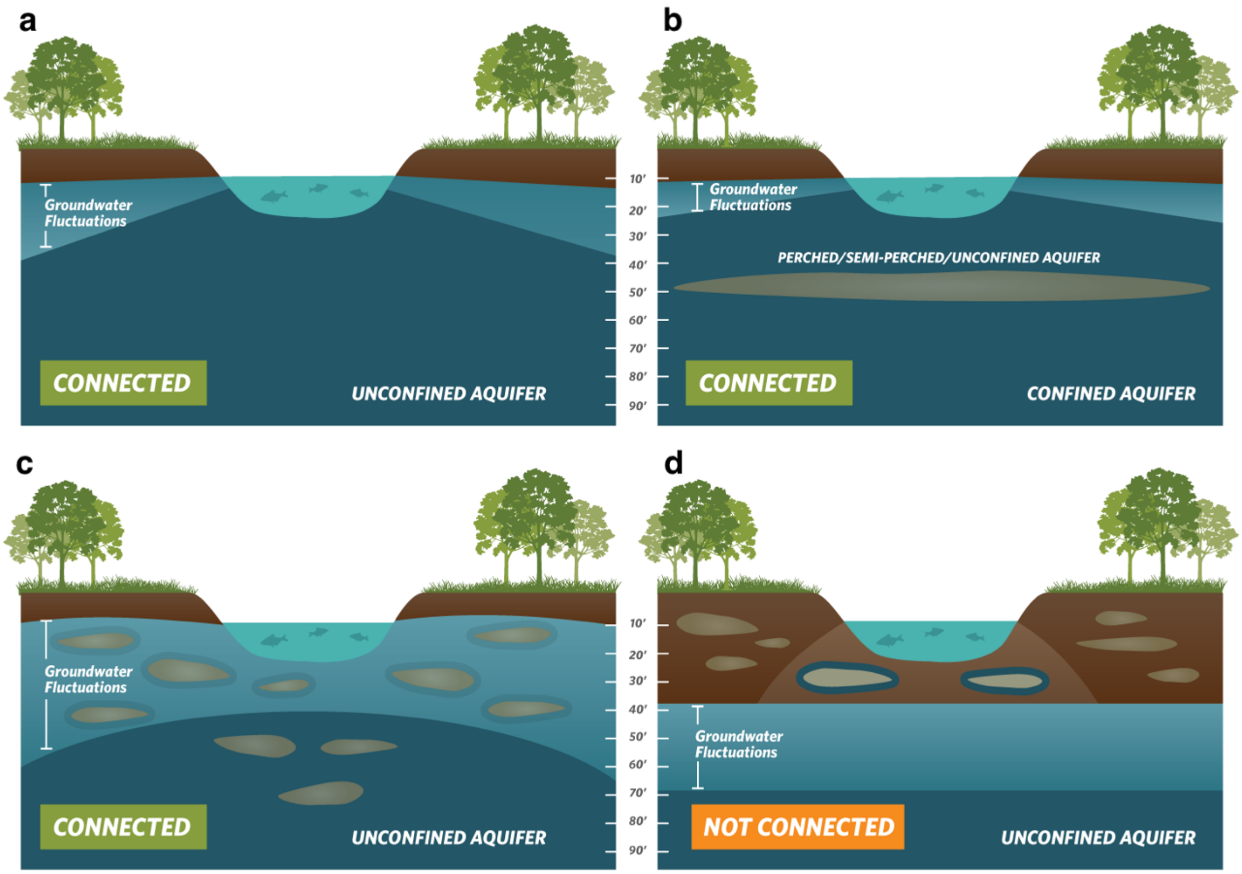

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

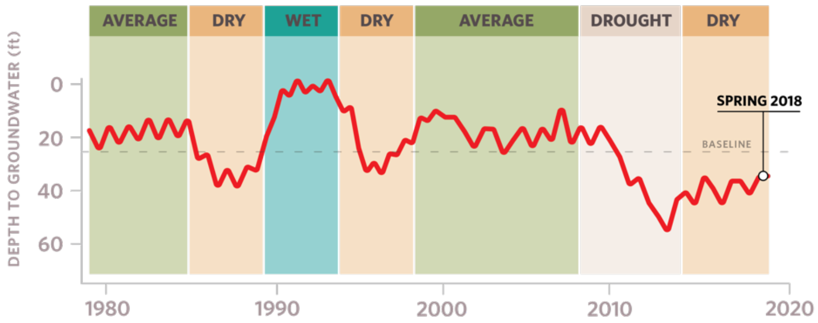

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

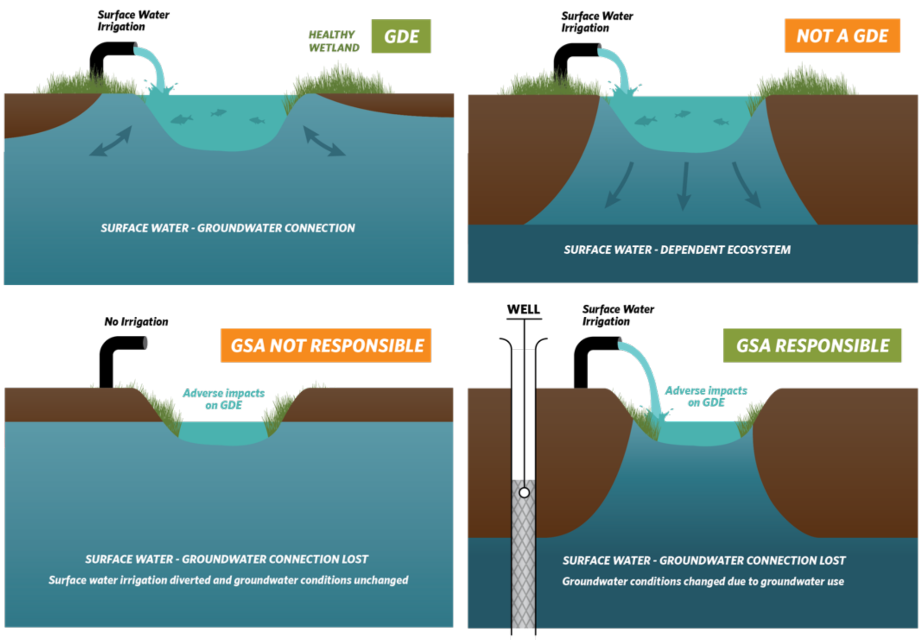


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA’s responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA’s responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

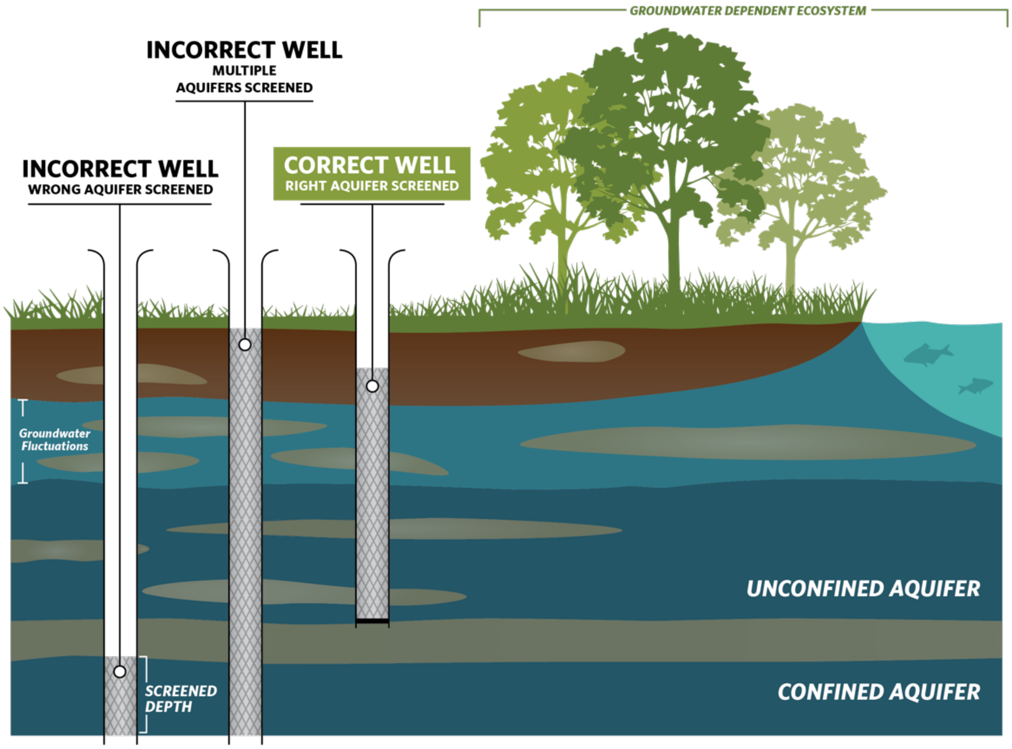


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

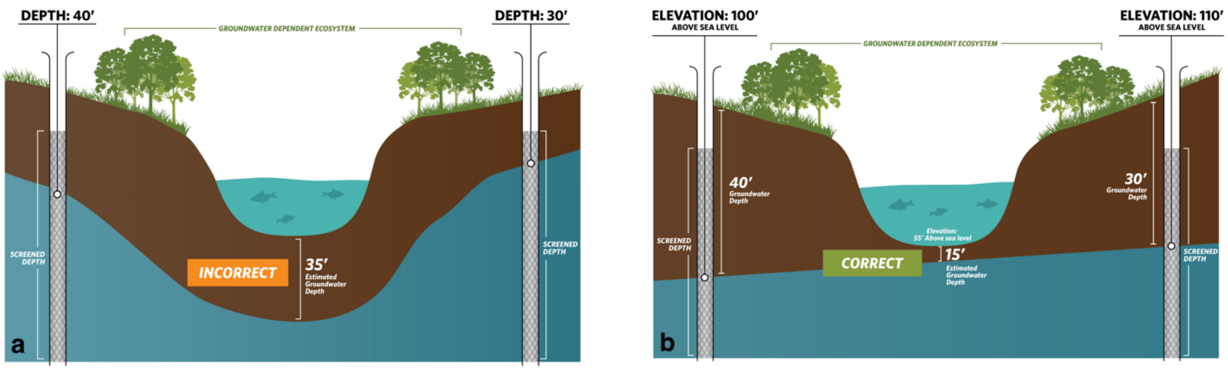


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

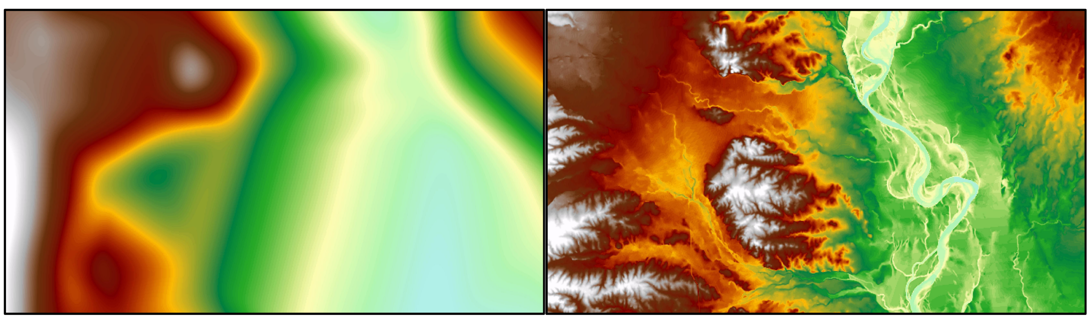


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

July 15, 2021

Eastern Municipal Water District
Water Resources Planning
P.O. Box 8300
Perris, CA 92572-8300
Submitted via email: grayr@emwd.org

Re: Public Comment Letter for the San Jacinto Groundwater Basin Draft GSP

Dear Rachel Gray,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the San Jacinto Groundwater Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, including drinking water users, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have plans** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the San Jacinto Groundwater Basin Draft GSP, along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the San Jacinto Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. While the GSP provides basic information on DACs, including identification by name and location on a map (Figure 2-9) as determined by the California Department of Water Resources' DAC Mapping Tool, and description of the size of the population in each DAC (Table 2-9), the plan fails to identify the population dependent on groundwater as their source of drinking water in these communities. The plan also fails to provide location and depth of domestic wells within the basin. These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, to support the development of water budgets using the best available information, and to support the development of sustainable management criteria, and projects and management actions that are protective of these users.

RECOMMENDATIONS
● Include map and inventory of the location of all domestic wells by location and by depth. ● Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). The GSP states that "Disadvantaged Communities (DACs) within the Plan Area receive water from cities, mutual water companies, or EMWD". However the GSP does not currently provide clear information on how and to what extent DAC members rely on groundwater.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **insufficient**. The GSP incorrectly excluded stream segments as ISWs based on lack of continuous saturation between surface and groundwater or the existence of ephemeral streams. However, there were significant data gaps, including data from multiple seasons and water year types, in the groundwater level data used in the mapping effort. The regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. Because of the exclusion of stream segments, potential ISW are not being managed in the GSP. Until a disconnection can be proven, include all potential ISW in the GSP. This is necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water

RECOMMENDATIONS
• Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. • Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. • Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, we found that some mapped features in the NC dataset were improperly disregarded, as described below.

- Mapped features in the NC dataset were disregarded if Normalized Difference Vegetation Index (NDVI) and Normalized Difference Moisture Index (NDMI) data downloaded from TNC's GDE Pulse Tool did not correlate with groundwater. This is an incorrect method, since a lack of a relationship does not preclude that groundwater is providing some of the ecosystem's water needs. If the ecosystem is tapping into shallow groundwater then the ecosystem should be categorized as a GDE. If there are no data to characterize groundwater conditions in the shallow principal aquifer, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP. Please note that the GSP Regulations define principal aquifers as "aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems." [23 CCR §351(aa)] regardless of pumping rates. Shallow aquifers that have the potential to support well development, support ecosystems, or provide baseflow to streams are principal aquifers; even if the majority of the basin's pumping is occurring in deeper principal aquifers.

- GDEs were disregarded based on the presence or proximity of surface water. However, partial reliance on surface water does not necessarily prove that the plants and animals do not access groundwater. Many GDEs often simultaneously rely on multiple sources of water (i.e., both groundwater and surface water), or shift their reliance on different sources on an interannual or inter-seasonal basis. Additionally, adverse impacts can occur to GDEs due to pumping that further separates groundwater from surface water.

RECOMMENDATIONS

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth to groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- In addition to describing the vegetation and wetland communities from the NC dataset in the GSP area (as provided in Tables 1-4 in Appendix J), please also provide an inventory, map, or description of fauna (e.g., birds, fish, amphibian) species in the basin and note any threatened or endangered species (see Appendix C in this letter for a list of freshwater species located in the San Jacinto groundwater basin).

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included into the water budget. The integration of these ecosystems into the water budget is **insufficient**. The water budget did not include the current, historical, and projected demands of native vegetation and managed wetlands (including the California Department of Fish and Wildlife's San Jacinto Wildlife Area). Groundwater losses due to evapotranspiration were not explicitly measured or modeled but instead were implicitly accounted for during development and calibration of the groundwater model. The omission of explicit water demands for native vegetation and managed wetlands is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

RECOMMENDATION

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation and managed wetlands.

[1] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]
[2] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the Public Outreach and Engagement Plan included in the GSP as Appendix F. This engagement plan presents only the bare minimum information and stakeholder engagement is primarily via public notification on the GSP website and interested parties email list.

- The opportunities for public involvement and engagement are limited to EMWD regular board meetings, SAG meetings and review of the EMWD website.

- The Stakeholder Advisory Group comprises mainly water utilities serving DACs. There are currently no DAC community members or private well owner representatives included in the Stakeholder Advisory Group. The plan states that "DAC community representatives are on the list of interested parties and the stakeholder advisory group (SAG) list of invitees". Similarly, the California Department of Fish and Wildlife was the only environmental stakeholder included in the Stakeholder Advisory Group during the GSP development process. The GSA has held only 6 Stakeholder Advisory Group meetings since 2015. We are concerned that this level of engagement is not sufficient to adequately engage and involve all beneficial users of groundwater.

- The Public Outreach and Engagement plan does not include a plan for continual opportunities for engagement through the implementation phase of the GSP for DACs or environmental stakeholders. The public outreach and engagement plan infers that stakeholders will be notified via public notification on the GSP websites and interested parties email lists.

- The GSP states that the GSA will communicate with domestic water-well owners to ensure that they understand their on-going opportunity to participate in development of the GSP. There is no documentation of how the GSA is carrying out this engagement. Similarly, the GSP states that EMWD works with DACs on other programs and will continue to coordinate with DACs within the GSA boundary. However, the plan fails to provide specific details on how they plan to conduct this outreach and engagement.

RECOMMENDATIONS

- Include a more detailed and robust Public Outreach and Engagement Plan that details how DAC community members and environmental stakeholders will be targeted and engaged during the remainder of the GSP development process and throughout the GSP implementation phase.

- Conduct outreach at frequented locations such as farmers markets, schools across the plan area providing translation services and technical assistance where needed. Refer to Attachment B for specific recommendations on how to actively engage community stakeholders.

Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

[3] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[4] and establishing minimum thresholds[5,6]

Disadvantaged Communities and Drinking Water Users

Many DACs rely on small public water systems, which are shallower and have very different characteristics from agricultural wells or larger urban water supply wells, and thus are more vulnerable to changes in water level and water quality. Additionally, because the location of domestic wells is not provided in the GSP, the impacts to the domestic well user population are unknown. The GSP neither describes nor analyzes direct or indirect impacts on DACs or domestic drinking wells when defining undesirable results for chronic lowering of groundwater levels or water quality. Therefore, the SMC provided in the GSP are not protective of DACs or domestic drinking wells.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Calculate and present on maps the anticipated change in water levels for measurable objectives and minimum thresholds relative to current groundwater conditions. These maps should clearly identify the locations of beneficial users, including DACs, populations dependent on domestic wells for drinking water, and small community water systems.
- Identify the location and number of domestic wells that would be anticipated to be impacted at the measurable objectives and minimum thresholds, utilizing well construction information available in DWR's Well Completion Report Map Application. Include an estimate of the population anticipated to be affected under these conditions. In order to mitigate against the undesirable result of community members losing access to drinking water, GSAs should identify a program to mitigate such impacts to these beneficial users.

Water Quality

- The plan only sets Minimum Thresholds (MTs) and Measurable Objectives (MOs) for total dissolved solutes (TDS). The GSA should set MTs and MOs for nitrates and ensure they align with drinking water standards[7].
- We recommend that the GSA provide distinct maps for VOC, nitrate and perchlorate contamination plumes as required in SGMA regulations[8].

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater or surface water when defining undesirable results. This

[4] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[5] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[6] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[7] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[8] "Groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes." [23 CCR §354.16(d)]

is problematic because without identifying potential impacts to GDEs and beneficial users of interconnected surface waters, minimum thresholds may compromise, or even irreparably destroy, environmental beneficial users. Since GDEs and managed wetlands are present in the basin, they must be considered when developing SMC for the basin. The comments above provide recommendations for re-evaluating the extent of GDEs and ISW in the basin.

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, water quality, and depletions of interconnected surface waters, please provide more specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results occur when 'significant and unreasonable' effects on beneficial users are caused by groundwater. Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the basin. Without defining undesirable results, the minimum thresholds cannot be determined. Potential effects on all beneficial users of groundwater in the basin need to be taken into consideration when defining undesirable results[9], establishing minimum thresholds[10], and the impacts to beneficial users of selected minimum thresholds must be analyzed.

- For the interconnected surface water SMC, the undesirable results should include a description of potential impacts on instream habitats within ISWs when defining minimum thresholds in the basin[11]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP (See Appendix B for a list of freshwater species in your basin). These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,12].

[9] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[10] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[11] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[12] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[13] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the GSP did not consider the 2070 wet and 2070 extremely dry climate scenarios in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

The sustainable yield is based on the historical water budget, which was augmented by several decades of imported water. It is unlikely that imported water allocations from the past will persist into the future under climate change. The GSP could be improved by more clearly documenting how climate change was incorporated into surface water flow inputs for the projected water budget, particularly for streamflow and imported water from the Colorado River Aqueduct and State Water Project.

If the water budgets are incomplete, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extreme wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Document how climate change was incorporated into surface water flow inputs for the projected water budget.
- The sustainable yield should be based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

[13] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**. Our comments above note data gaps in the shallow monitoring networks for GDEs, ISWs, and DACs. The GSP fails to provide justification for having only 11 representative monitoring points across the plan area thereby failing to meet SGMA's requirements[14]. The lack of shallow monitoring wells and/or the lack of plans for future monitoring threatens GDEs, aquatic habitats, surface water users and shallow domestic well water. Potential GDEs are located in areas of the subbasin where no shallow groundwater monitoring currently exists or is proposed, leaving data gaps unfilled. Potential ISWs have been dismissed in the GSP, without proposed recommendations to improve ISW identification, mapping, and estimates of depletions. Appropriate monitoring is necessary so that groundwater conditions within GDEs and ISWs are characterized and surface-shallow groundwater interactions are fully integrated into the GSP.

RECOMMENDATIONS

- Provide maps that overlay monitoring well locations with the locations of DACs and GDEs to clearly identify potentially impacted areas.
- Reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs, and identify DACs and shallow domestic well users that are vulnerable to undesirable results.
- Increase the number of representative monitoring points (RMPs) across the basin for all groundwater condition indicators. Prioritize proximity to DACs and drinking water users when identifying new RMPs.
- Determine what ecological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient.** The GSP states that projects and management actions are not necessary to achieve sustainability in the Plan Area, which has experienced rising groundwater levels and increased groundwater in storage over the past 30 years due to imported water supplies. Thus, the project and management actions proposed are not being implemented until undesirable results occur and the sustainable yield (which was incorrectly based on the historic water budget versus the projected water budget) is reached. The plan fails to meet SGMA requirements[15] by stating that public notice will not be required for some of the identified projects and management actions.

[14] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

[15] "Each Plan shall include a description of the projects and management actions that include the following: the process by which the Agency shall provide notice to the public and other agencies that the implementation of projects or management actions is being considered or has been implemented, including a description of the actions to be taken." [23 CCR §354.44(b)(1)(B))]

RECOMMENDATIONS

Because GDEs, aquatic habitats, surface water users, DACs, and shallow domestic well water users were not sufficiently identified in the GSP, please consider including the following related to potential project and management actions in the GSP:

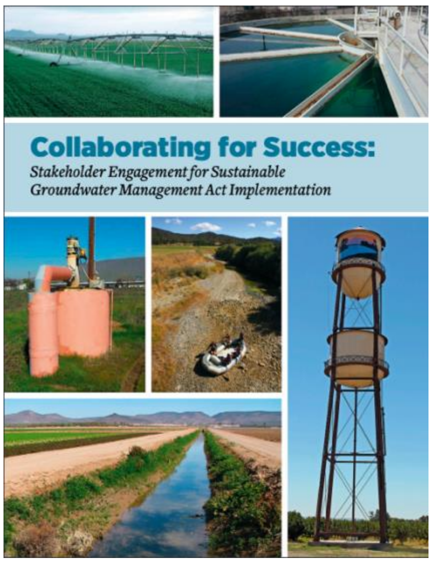
- For GDEs and ISWs, recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[16].
- For all beneficial users, provide public notice and engagement before consideration and implementation of the three management actions and two projects identified.
- For DACs, monitor the impacts of selected management actions and projects on communities and drinking water users.
- For DACs and domestic well owners, implement a drinking water well mitigation program to avoid the significant and unreasonable loss of drinking water. This could include a combination of replacing impacted wells with new, deeper wells and/or connecting domestic users to a public water system.
- For DACs, a discussion of whether potential impacts to water quality from projects and management actions could occur.
- Develop management actions to prevent future undesirable results that incorporate climate and water delivery uncertainties and address water demand.

[16] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



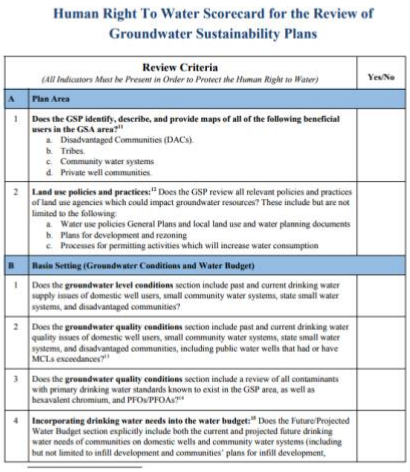
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

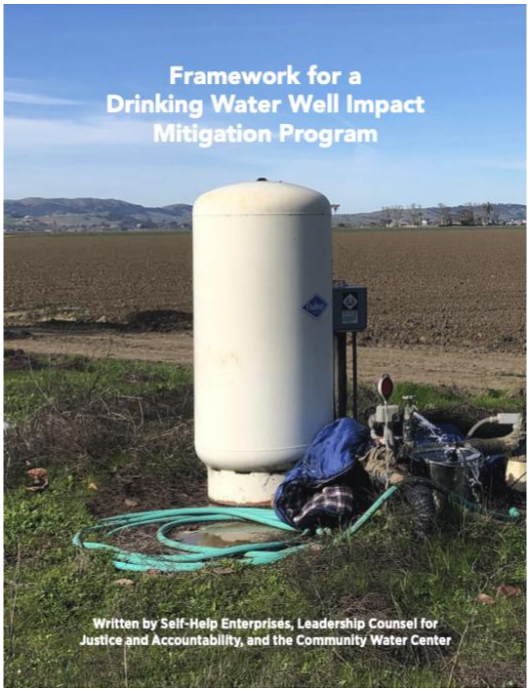


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

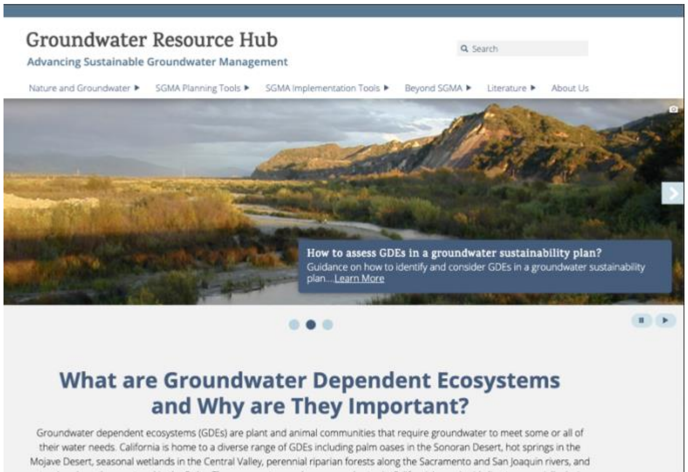
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



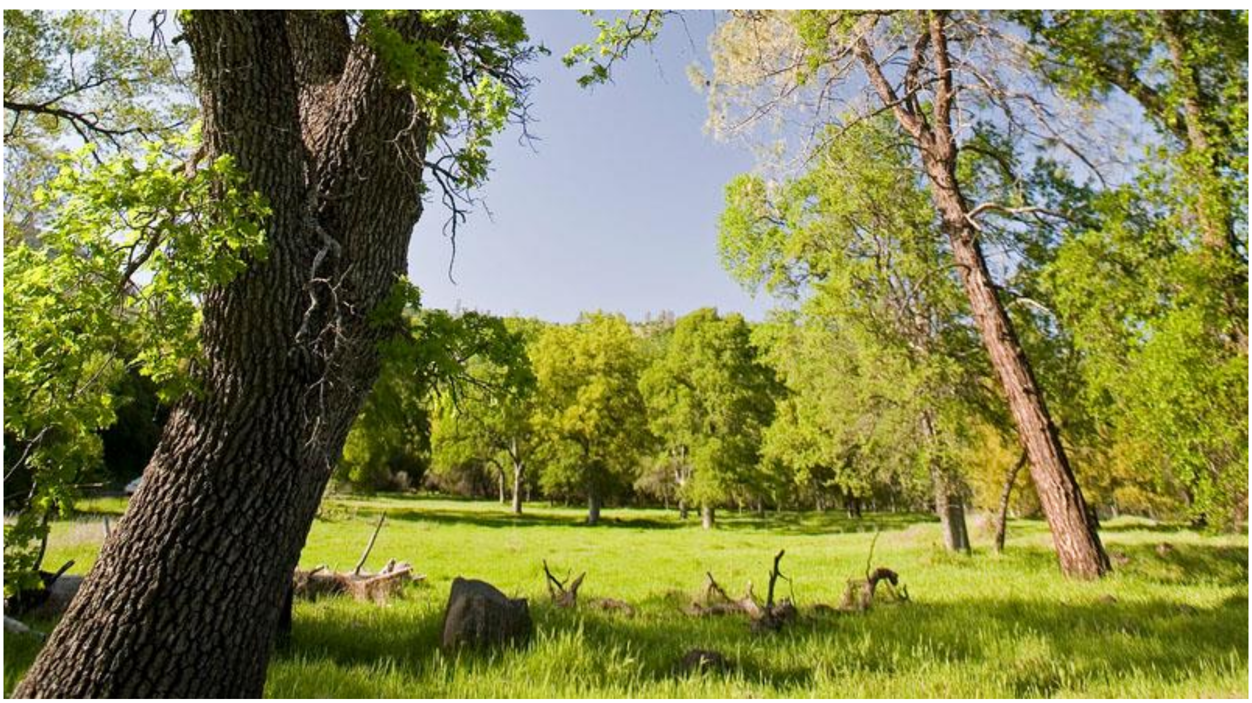
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

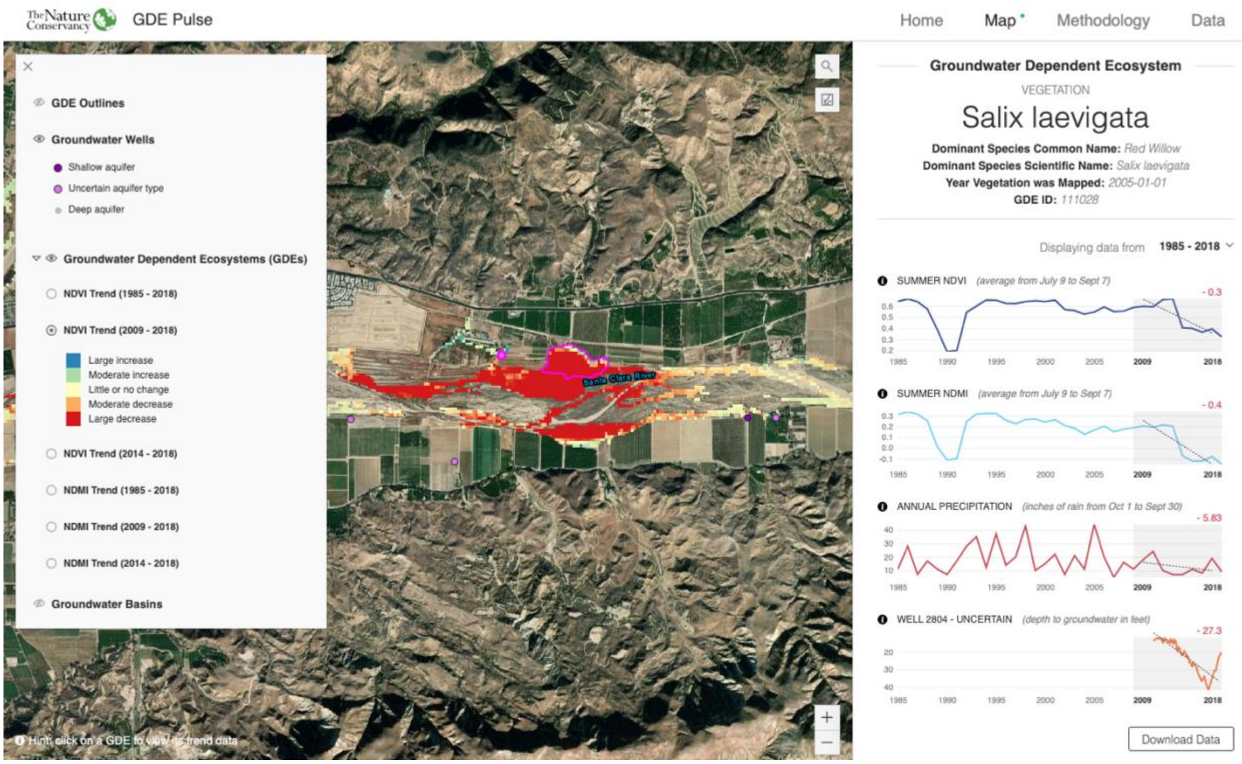
1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](https://) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

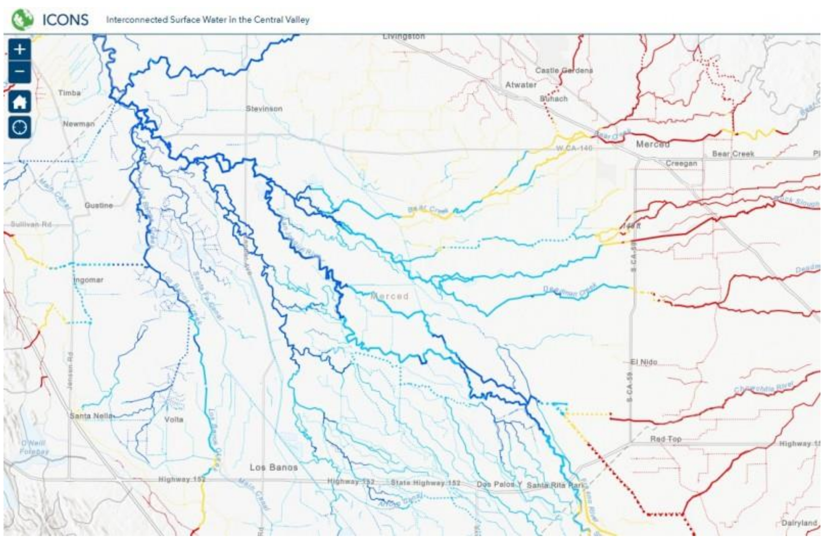
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the San Jacinto Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", this attachment provides a list of freshwater species located in the San Jacinto Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Dendrocygna bicolor	Fulvous Whistling-Duck		Special Concern	BSSC - First priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Empidonax traillii brewsteri	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Gelochelidon nilotica vanrossemi	Gull-billed Tern	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority

Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Pipilo aberti	Abert's Towhee			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Rynchops niger	Black Skimmer			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Cambaridae fam.	Cambaridae fam.			

Hyalella spp.	Hyalella spp.			
Streptocephalus woottoni	Riverside Fairy Shrimp	Endangered	Special	IUCN - Endangered
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern	ARSSC
Pseudacris cadaverina	California Treefrog			ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Anaxyrus boreas halophilus	California Toad			ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
INSECTS & OTHER INVERTS				
Ablabesmyia spp.	Ablabesmyia spp.			
Aeshna spp.	Aeshna spp.			
Agapetus spp.	Agapetus spp.			
Alotanypus spp.	Alotanypus spp.			
Apedilum spp.	Apedilum spp.			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetidae fam.	Baetidae fam.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Berosus spp.	Berosus spp.			
Brillia spp.	Brillia spp.			
Callibaetis spp.	Callibaetis spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			

Cyphomella spp.	Cyphomella spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Dytiscidae fam.	Dytiscidae fam.			
Endochironomus spp.	Endochironomus spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Ephydridae fam.	Ephydridae fam.			
Erpetogomphus spp.	Erpetogomphus spp.			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Glyptotendipes spp.	Glyptotendipes spp.			
Gumaga spp.	Gumaga spp.			
Helicopsyche spp.	Helicopsyche spp.			
Hydrobius fuscipes				Not on any status lists
Hydrobius spp.	Hydrobius spp.			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Labrundinia spp.	Labrundinia spp.			
Laccobius spp.	Laccobius spp.			
Lepidostoma spp.	Lepidostoma spp.			
Leptoceridae fam.	Leptoceridae fam.			
Leptohyphidae fam.	Leptohyphidae fam.			
Libellulidae fam.	Libellulidae fam.			
Maruina lanceolata				Not on any status lists
Micrasema spp.	Micrasema spp.			
Micropsectra spp.	Micropsectra spp.			
Microtendipes spp.	Microtendipes spp.			
Nectopsyche spp.	Nectopsyche spp.			
Neoclypeodytes cinctellus				Not on any status lists
Nilotanypus spp.	Nilotanypus spp.			
Nilothauma spp.	Nilothauma spp.			
Notonecta spp.	Notonecta spp.			
Ochrotrichia spp.	Ochrotrichia spp.			
Oxyethira spp.	Oxyethira spp.			
Pantala flavescens	Wandering Glider			
Pantala hymenaea	Spot-winged Glider			

Paracymus spp.	Paracymus spp.			
Paramerina spp.	Paramerina spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Paratendipes spp.	Paratendipes spp.			
Peltodytes spp.	Peltodytes spp.			
Pentaneura spp.	Pentaneura spp.			
Polycentropus spp.	Polycentropus spp.			
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Prosimulium spp.	Prosimulium spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Psychodidae fam.	Psychodidae fam.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Sanfilippodytes spp.	Sanfilippodytes spp.			
Serratella spp.	Serratella spp.			
Simulium donovani				Not on any status lists
Simulium piperi				Not on any status lists
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Stictotarsus spp.	Stictotarsus spp.			
Sympetrum corruptum	Variegated Meadowhawk			
Tanypus spp.	Tanypus spp.			
Tanytarsus spp.	Tanytarsus spp.			
Thienemannimyia spp.	Thienemannimyia spp.			
Tinodes spp.	Tinodes spp.			
Tramea calverti				Not on any status lists
Tramea lacerata	Black Saddlebags			
Tramea onusta	Red Saddlebags			
Trichocorixa spp.	Trichocorixa spp.			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
MOLLUSKS				
Ferrissia spp.	Ferrissia spp.			
Gyraulus spp.	Gyraulus spp.			
Helisoma spp.	Helisoma spp.			

Lymnaea spp.	Lymnaea spp.			
Lymnaeidae fam.	Lymnaeidae fam.			
Physa spp.	Physa spp.			
Physella virgata	Protean Physa			CS
Physella virginea	Sunset Physa			CS
Physidae fam.	Physidae fam.			
Pisidium spp.	Pisidium spp.			
Promenetus spp.	Promenetus spp.			
PLANTS				
Lasthenia glabrata coulteri	Coulter's Goldfields		Special	CRPR - 1B.1
Navarretia fossalis	Spreading Navarretia	Threatened	Special	CRPR - 1B.1
Orcuttia californica	California Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Alnus rhombifolia	White Alder			
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Ammannia robusta	Grand Redstem			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla filiculoides	NA			
Baccharis salicina				Not on any status lists
Bergia texana	Texas Bergia			
Bolboschoenus glaucus	NA			Not on any status lists
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Bolboschoenus robustus				Not on any status lists
Callitriche marginata	Winged Water-starwort			
Castilleja minor minor	Alkali Indian-paintbrush			
Castilleja minor spiralis	Large-flower Annual Indian-paintbrush			
Crassula aquatica	Water Pygmyweed			
Crassula solieri	NA			Not on any status lists
Crypsis vaginiflora	NA			
Cyperus acuminatus	Short-point Flatsedge			
Cyperus erythrorhizos	Red-root Flatsedge			
Datisca glomerata	Durango Root			

Downingia cuspidata	Toothed Calicoflower			
Echinochloa oryzoides	NA			
Echinodorus berteroi	Upright Burhead			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis engelmannii engelmannii	Engelmann's Spikerush			Not on any status lists
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Eleocharis parishii	Parish's Spikerush			
Epilobium campestre	NA			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Hydrocotyle umbellata	Many-flower Marsh-pennywort			
Juncus dubius	Mariposa Rush			
Juncus macrophyllus	Longleaf Rush			
Juncus textilis	Basket Rush			
Juncus xiphioides	Iris-leaf Rush			
Lemna gibba	Inflated Duckweed			
Lemna minuta	Least Duckweed			
Limosella aquatica	Northern Mudwort			
Ludwigia peploides peploides	NA			Not on any status lists
Lythrum californicum	California Loosestrife			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus guttatus	Common Large Monkeyflower			
Mimulus pilosus				Not on any status lists
Myosurus minimus	NA			
Paspalum distichum	Joint Paspalum			
Persicaria lapathifolia				Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phacelia distans	NA			
Pilularia americana	NA			

Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pluchea sericea	Arrow-weed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Ranunculus aquatilis aquatilis	White Water Buttercup			
Ranunculus sceleratus	NA			
Rorippa curvipes	Rocky Mountain Yellowcress			
Rorippa sphaerocarpa	Round-fruit Yellowcress			
Rumex conglomeratus	NA			
Rumex salicifolius salicifolius	Willow Dock			
Rumex violascens	Violet Dock			
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Schoenoplectus americanus	Three-square Bulrush			
Scirpus microcarpus	Small-fruit Bulrush			
Stachys ajugoides	Bugle Hedge-nettle			
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	NA			
Veronica catenata	NA			Not on any status lists
Veronica peregrina	NA			
Wolffia columbiana	Columbian Watermeal			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

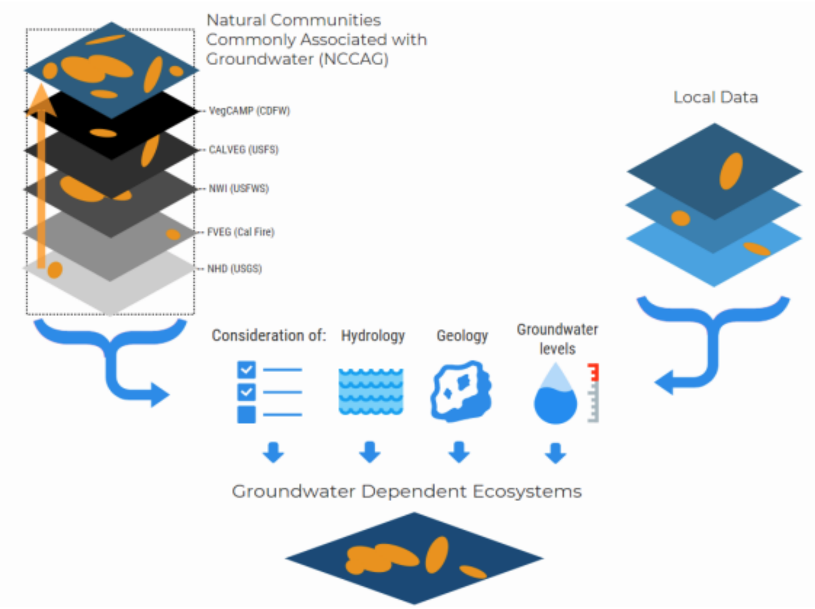


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

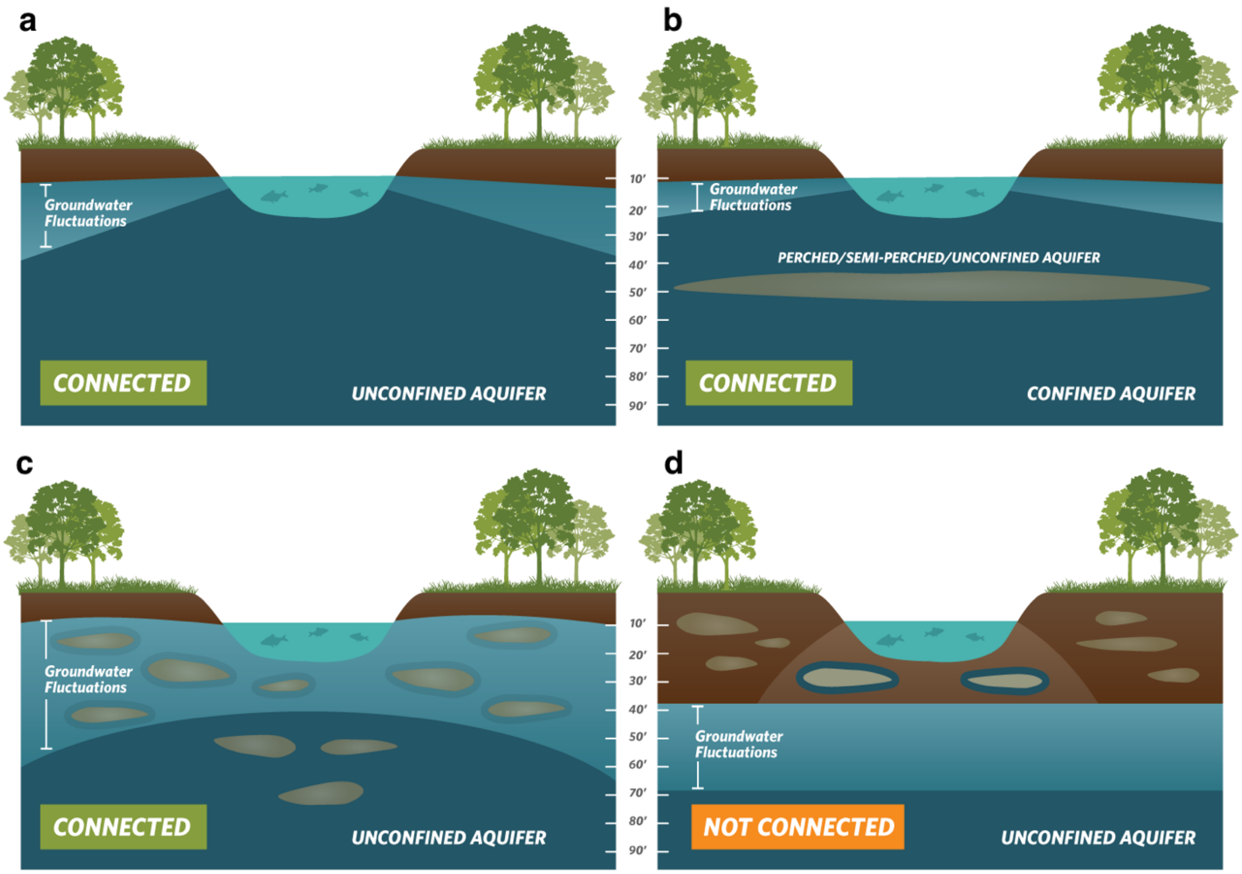

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

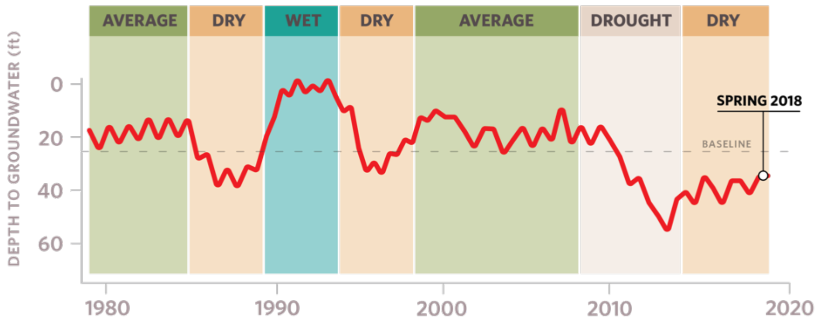

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

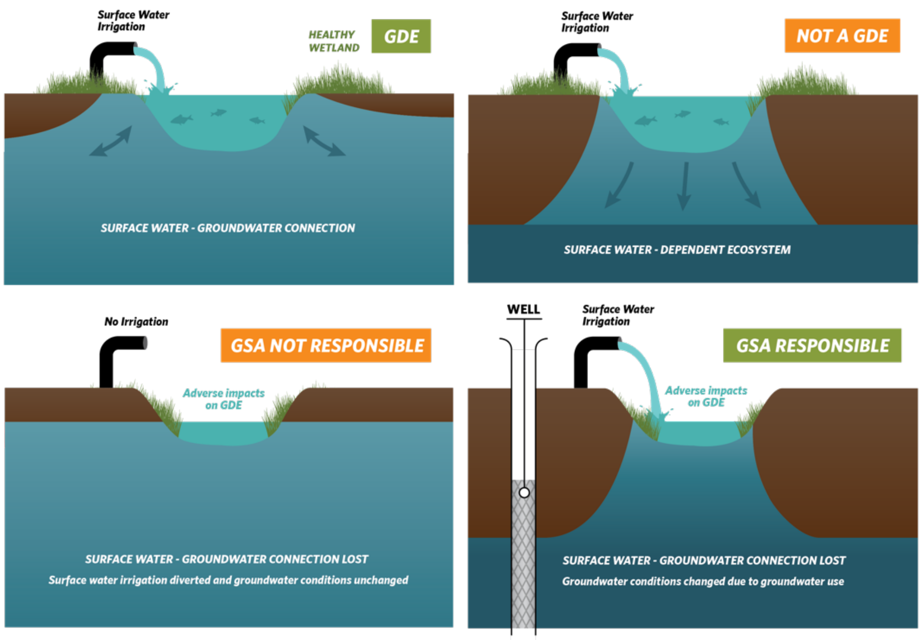

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

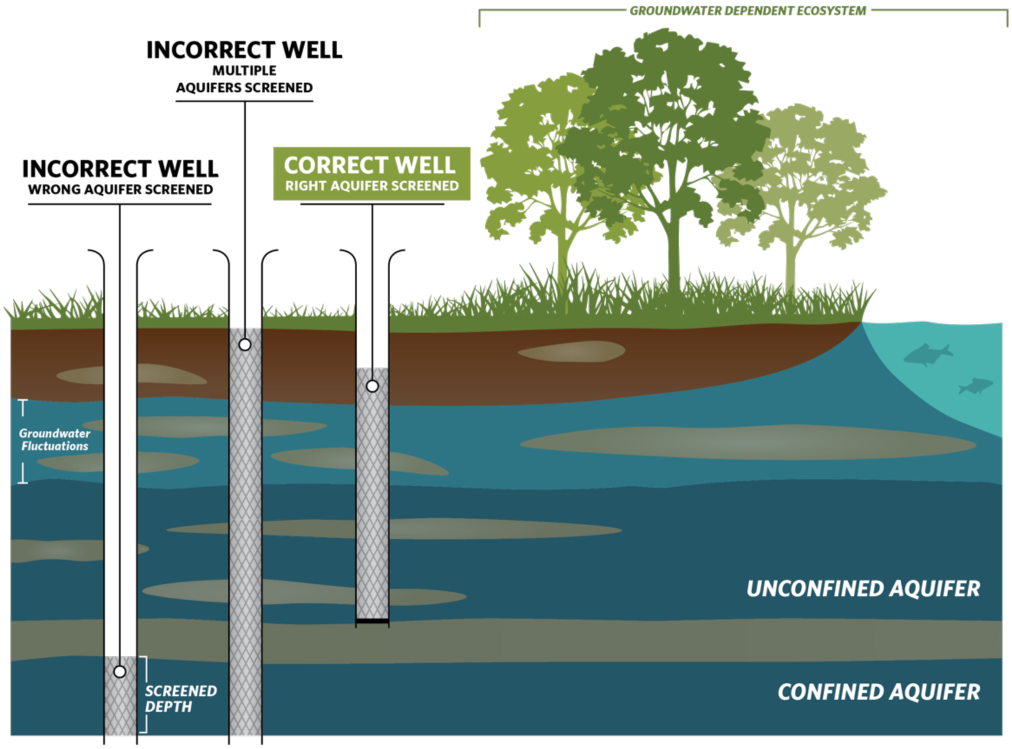

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

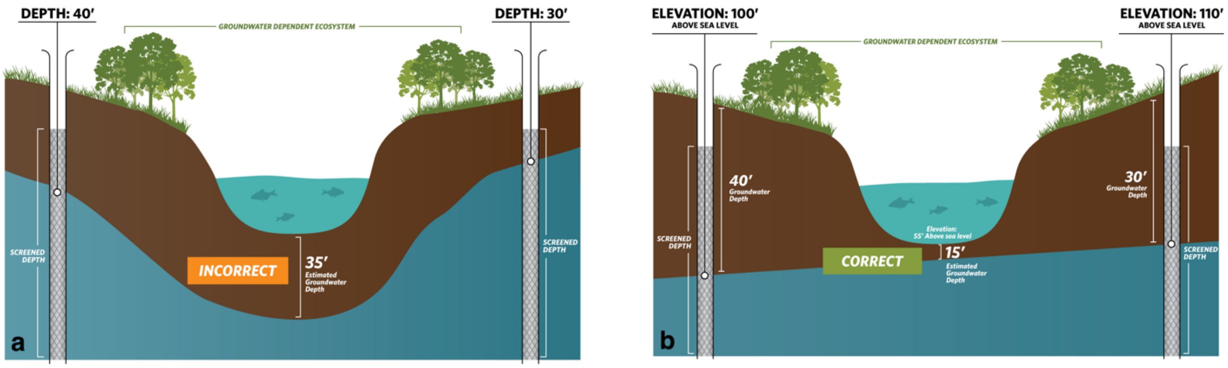

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

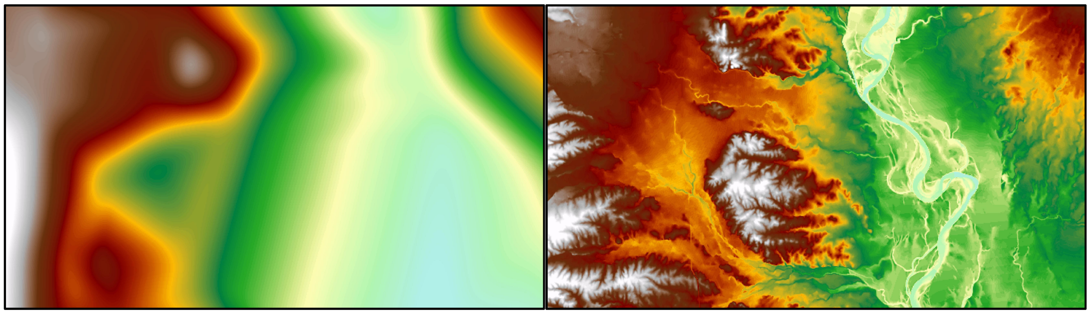

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

September 19, 2021

San Luis Obispo Valley Groundwater Basin Groundwater Sustainability Agencies

Submitted via web: https://portal.slowaterbasin.com/comment/new

Re: Public Comment Letter for San Luis Obispo Valley Basin Draft GSP

Dear Chung-te "Dick" Tzou,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the San Luis Obispo Valley Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the San Luis Obispo Valley Basin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the San Luis Obispo Valley Basin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. We note the following deficiencies with the identification of these key beneficial users.

- The GSP states in the Communication and Engagement Plan (Appendix E) that the city of San Luis Obispo is recognized as a DAC and references the DWR Disadvantaged Communities Mapping Tool. The GSP however does not show the city boundaries on a map or give the population of the DAC area.
- The GSP provides a map of domestic well density in Figure 3-5 but fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the basin.
- The GSP fails to identify the population dependent on groundwater as their source of drinking water in the basin. Specifics are not provided on how much the DAC community relies on a particular water supply (e.g., what percentage is supplied by groundwater).

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, to support the development of water budgets using the best available information, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS
• Provide a map of the boundaries of San Luis Obispo, the recognized DAC in the basin. Provide the population of the DAC. • Include a map showing domestic well locations and average well depth across the basin.

- Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **insufficient**, due to lack of clarity around the monitoring well data (spatial and temporal) used to map interconnected stream reaches.

The GSP states that the groundwater and surface water are generally connected in the San Luis Valley and generally disconnected in the Edna Valley, but only two wells and stream gauges are mentioned in the assessment in that area. More data is needed to make these claims. The plan concludes that no surface water depletion has been caused by groundwater decline in the basin. This statement is not supported by sufficient spatial and temporal data based on the location of groundwater wells and stream gauges in the basin and the frequency with which they have been sampled.

The GSP states (p. 5-26): "In cases where average springtime water levels were greater than the elevation of the adjacent San Luis Obispo Creek channel, the stream reach was considered as potentially 'gaining'. In cases where average springtime water levels were below the adjacent channel elevation, the stream reach was considered 'losing' and potentially 'disconnected'." The GSP implies with this statement that losing streams equate to disconnected streams, but this is not true because losing reaches are still connected with the saturated zone. The regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

RECOMMENDATIONS

- Provide more discussion in the GSP about the groundwater elevation data used to verify interconnected reaches. Include a map of the interpolated groundwater elevations and spatial extent of groundwater monitoring wells used to produce the map.

- On Figure 5-16 (Losing and Gaining Reaches Within the Basin), also denote interconnected and disconnected reaches within the basin. Clarify in the text that losing reaches do not equate to disconnected reaches.

- On Figure 5-16, clearly label the areas with data gaps. While the GSP identifies data gaps in the text, we recommend that the GSP considers any segments with data gaps as potential ISWs and clearly marks them as such on maps provided in the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of comprehensive, systematic analysis of the basin's GDEs.

The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources. However, we found that some mapped features in the NC dataset were improperly disregarded, as described below.

- NC dataset polygons were incorrectly removed based on groundwater levels that were greater than 30-ft in 2019, a single point in time. This is a technically incorrect approach since groundwater levels fluctuate over seasonal and interannual time scales due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Justifying the removal of NC dataset polygons solely based on this criterion does not acknowledge that groundwater levels temporally vary and the fact that many plant species within GDEs can access groundwater depths beyond 30-feet or have adapted water stress strategies to deal with intermittent periods of deep groundwater levels. Using this methodology disregards groundwater fluctuations and may result in the omission of ecosystems that are groundwater dependent.
- The GSP is not clear on its use of depth thresholds to analyze GDEs. The GSP states (p. 5-32): "Oak woodlands were considered potentially groundwater dependent due to their deep rooting depths (up to 70 feet (Lewis, 1964))." However, the next sentence is: "Potential vegetation and wetland GDEs were retained if the underlying depth to water in 2019 was inferred to be 30 feet or shallower based on the existing well network (Figure 5-17)."

We commend the GSA for listing special-status species and sensitive natural communities (Appendix F, Table 1) and a summary of GDE types in the basin (Appendix F, Table 2) using TNC's freshwater species list and Critical Species Lookbook, among other sources.

RECOMMENDATIONS
• Develop and describe a systematic approach for analyzing the basin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained, removed, or added to/from the NC dataset (include the removal reason if polygons are not considered potential GDEs, or include the data source if polygons are added). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. • Clarify the use of depth thresholds in the GDE analysis. Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as valley oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included in the water budget. The integration of native vegetation into the water budget is **insufficient**. The GSP states that native vegetation is one of the land use types included in developing the water budget. However, the water budget did not include a separate item for the current, historical, and projected demands of native vegetation. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.

- State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

[1] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[2] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**, based on lack of targeted engagement and outreach to environmental stakeholders. The Communication and Engagement Plan (Appendix E) identifies environmental users as stakeholders but does not include targeted engagement opportunities for them, and only provides details on engagement opportunities for *all* stakeholders listed. Therefore, SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the Stakeholder Communication and Engagement Plan.

We commend the GSAs for targeted outreach and engagement to DACs in the basin. These opportunities include hosting informational events at local Farmers Markets, promoting meetings and updates around city kiosks and places where utility bills are paid, the parks and recreation departments where after school programs take place, and the senior citizens center. The Communication and Engagement Plan also includes general stakeholder engagement such as access to public meetings, access to SGMA-related material and GSP development notifications in non-English languages, surveys and workshops.

We also commend the GSAs for engaging with the Northern Chumash Tribe, which encompasses the County area. The Communication and Engagement Plan refers to DWR's Engagement with Tribal Governments Guidance Document.

The Communication and Engagement Plan does not include a plan for continued opportunities for engagement through the *implementation* phase of the GSP targeted to DACs, domestic well owners, tribes, and environmental stakeholders.

RECOMMENDATIONS

- In the Communication and Engagement Plan, describe outreach and engagement targeted specifically to environmental stakeholders.
- In the Communication and Engagement Plan, describe active and targeted outreach to engage DAC members, domestic well owners, tribes, and environmental stakeholders throughout the GSP *implementation* phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.
- Include a map showing the jurisdictional boundaries of tribal lands within the basin.

[3] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[4] and establishing minimum thresholds.[5,6]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP describes impacts to domestic drinking water wells when defining undesirable results, and the GSP describes how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results in the basin. These are described through an analysis presented in the GSP (p. 8-15) to evaluate potential water level of minimum thresholds compared to the depths of private domestic wells identified in County data. The basin-wide fall 2015 groundwater elevations were mapped and compared to the total depths of domestic wells in the County's well permitting database.

The GSP does not however, specifically analyze direct and indirect impacts on DACs, drinking water users and tribes when defining undesirable results or evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

The GSP states that the constituents of concern (COCs) in the basin are total dissolved solids (TDS), nitrate, arsenic, boron, and volatile organic compounds tetrachloroethylene (PCE) and trichloroethylene (TCE). The minimum thresholds for TDS, nitrate, arsenic, boron, PCE and TCE are presented in Table 8-3 and are based on the primary or secondary maximum contaminant limit (MCL). No minimum threshold is set for boron.

For degraded water quality, the GSP only includes a very general discussion of indirect impacts to drinking water users when defining undesirable results and evaluating the cumulative or indirect impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss impacts to DACs, drinking water users or tribes, or otherwise consider these stakeholders, when discussing SMC for degraded water quality.

The GSP states that for water quality SMCs, minimum thresholds are equal to measurable objectives. The plan also states that sustainability indicator constituents selected for groundwater quality are total dissolved solids (TDS), nitrate, and arsenic; the GSP excludes the PCE plume, also known as the South San Luis Obispo (SLO) PCE Plume, and a TCE plume, also known as the Buckley Road Area plume. It also excludes selenium which has been observed at concentrations that affect well operations at individual wells in the basin.

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[4] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[5] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[6] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels (in addition to describing impacts to drinking water users).

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users, DACs and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[7]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.

- In Table 8-3, state explicitly what value the minimum thresholds listed are based on (e.g., primary or secondary MCL).

- Select lower values for groundwater quality measurable objectives.

- Include SMC for all constituents of concern within the basin. Ensure they align with federal, state or local drinking water standards[8].

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP only considers GDEs with respect to the depletion of interconnected surface water sustainability indicator, but not the chronic lowering of groundwater levels sustainability indicator. No analysis is done to set SMC that consider GDEs directly dependent on groundwater.

The GSP states the following with respect to the depletion of interconnected surface water SMC (p. 8-37): "The Basin will be considered to have undesirable results if any of the representative wells monitoring interconnected surface water display exceedances of the minimum threshold values for two consecutive Fall measurements." The GSP states further (p. 8-38): "Because there have been no historical groundwater level declines in the ISW RMS [Representative Monitoring Site] wells, the MTs are defined at these three RMSs as the lowest historically observed water level in the period of record."

Establishing minimum thresholds based on the lowest historically observed water level does not consider any impacts on beneficial users and can result in 'significant and unreasonable' impacts. This is especially problematic for GDEs and ISW habitats, since managing the basin to historically low (drought) conditions can result in irreparable harm to these sensitive ecosystems. Groundwater conditions that deplete streamflow and lower groundwater elevations such that GDEs, particularly those with listed species, experience mortality and are unable to perform key life processes (e.g., reproduction, migration) are 'significant and unreasonable'. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and

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[7] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[8] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

unreasonable effects on surface water beneficial users in the basin, such as the federally threatened South-Central California Coast steelhead.

RECOMMENDATIONS
• When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[9] in the basin. Defining undesirable results is the crucial first step before the minimum thresholds[10] can be determined.   • When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when defining minimum thresholds in the basin[11]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,12].

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[13] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2070. However, the GSP did not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select

[9] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[10] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[11] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]
[12] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf
[13] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

The GSP includes climate change into precipitation, evapotranspiration, and surface water flow terms of the projected water budget. However, the GSP does not calculate a sustainable yield based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of RMSs in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs and domestic wells in the basin. These beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[14].

The six groundwater level monitoring sites and five surface water flow monitoring sites appear sufficient to fill shallow monitoring well data gaps around GDEs and ISWs in the monitoring network. The GDE Technical Memo (Appendix F) states: "Wells where the screened depth is unknown may be measuring groundwater levels for deeper aquifers that are unconnected to the shallow groundwater system and thus groundwater deeper than 30 ft for a given well may not reflect the absence of shallow groundwater, but instead reflects the absence of data. To determine the hydraulic connectivity between potential perched aquifers to the regional aquifer, additional monitoring with nested piezometers could be utilized." This noted data gap appears to be filled by the additional monitoring sites, but the GSP does not explicitly state this.

[14] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

RECOMMENDATIONS

- Provide maps that overlay monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify potentially impacted areas. Increase the number of RMSs across the subbasin for all groundwater condition indicators. Prioritize proximity to DACs and drinking water users when identifying new RMSs.
- State in the GSP whether the additional six groundwater level monitoring sites and five surface water flow monitoring sites will fill the data gap noted in Appendix F.
- Determine what biological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin. The GSP states (p. 5-29): "Additional field reconnaissance is necessary to verify the existence and extent of these potential GDEs and may be considered as part of the monitoring effort for future planning efforts." No further detail, however, is provided.
- Clarify the symbols used on Figure 7-1 (Water Level Monitoring Network). Many wells are shown on this map but only a few have the teal box representing chronic water level decline monitoring well locations.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to beneficial users of groundwater such as DACs and drinking water users.

We commend the GSAs for including projects and management actions with explicit benefits to the environment, particularly the Price Canyon Discharge Relocation. The GSP does not discuss the manner in which DACs and drinking water users may be benefitted or impacted by identified projects and management actions. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

RECOMMENDATIONS

- For DACs and domestic well owners, include discussion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.
- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[15].

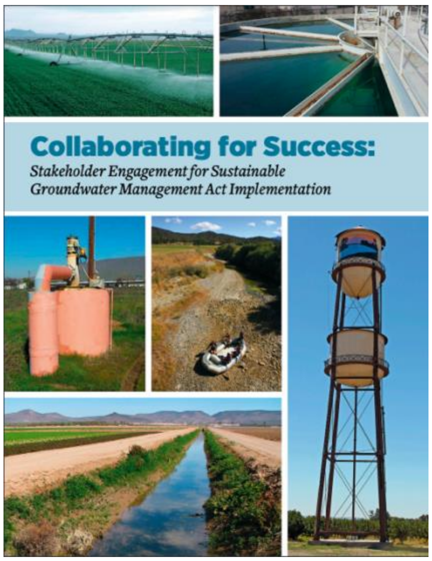
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[15] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



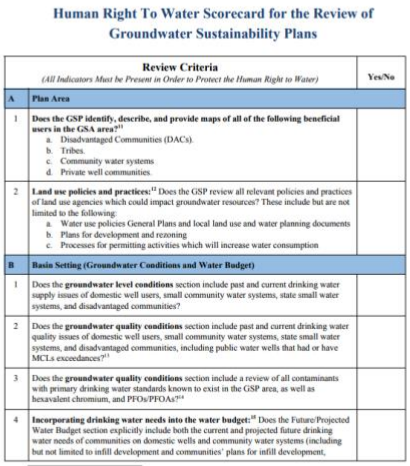
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

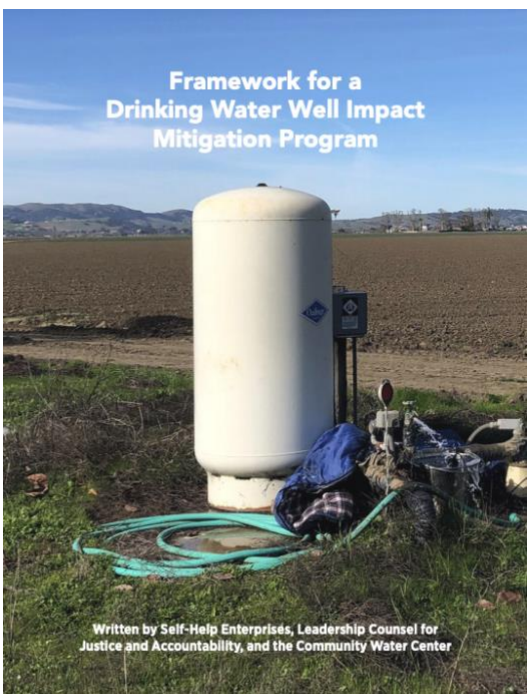
The Human Right to Water


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria (All Indicators Must be Present in Order to Protect the Human Right to Water)	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

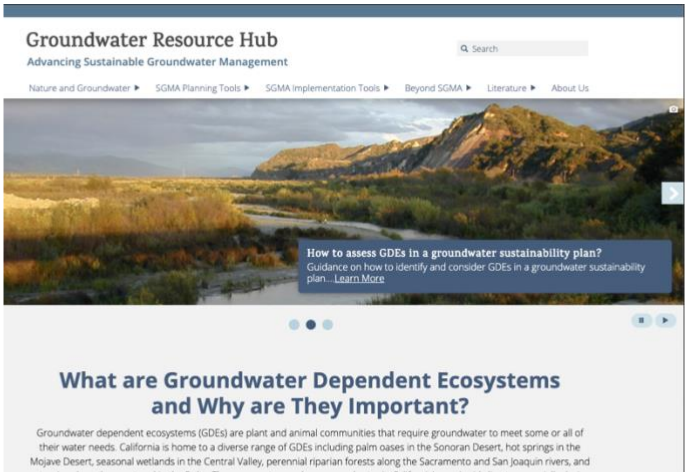
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



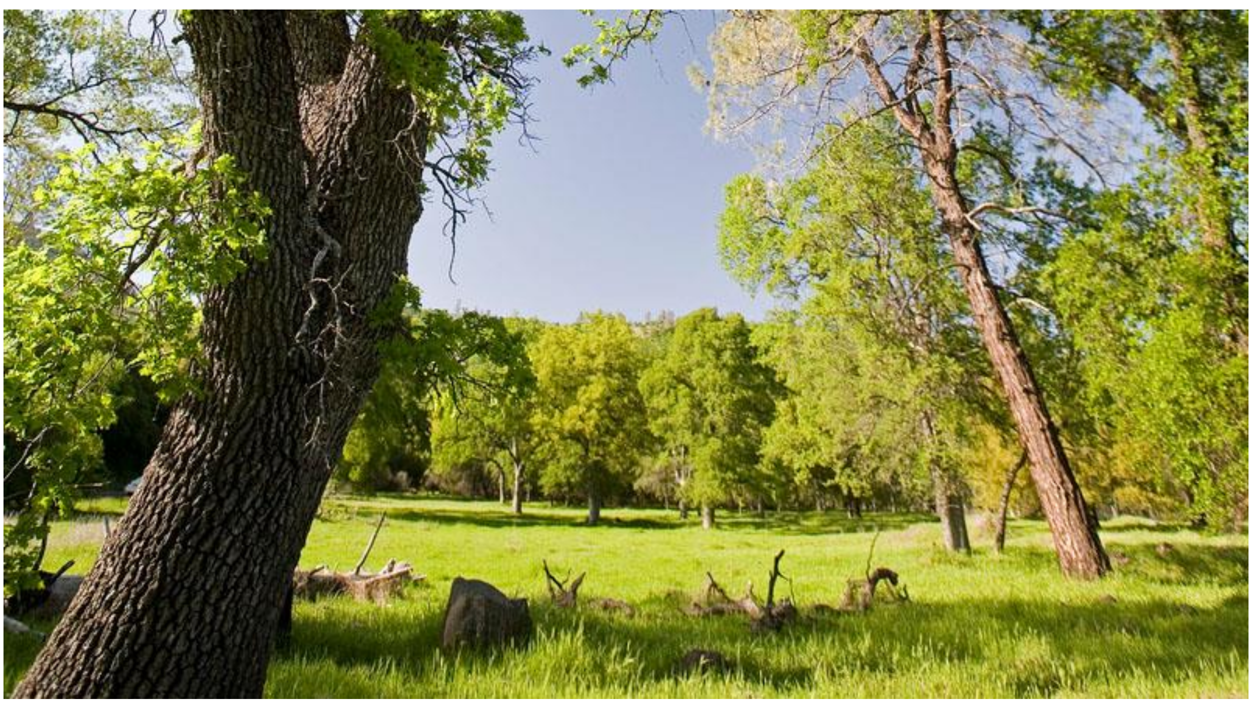
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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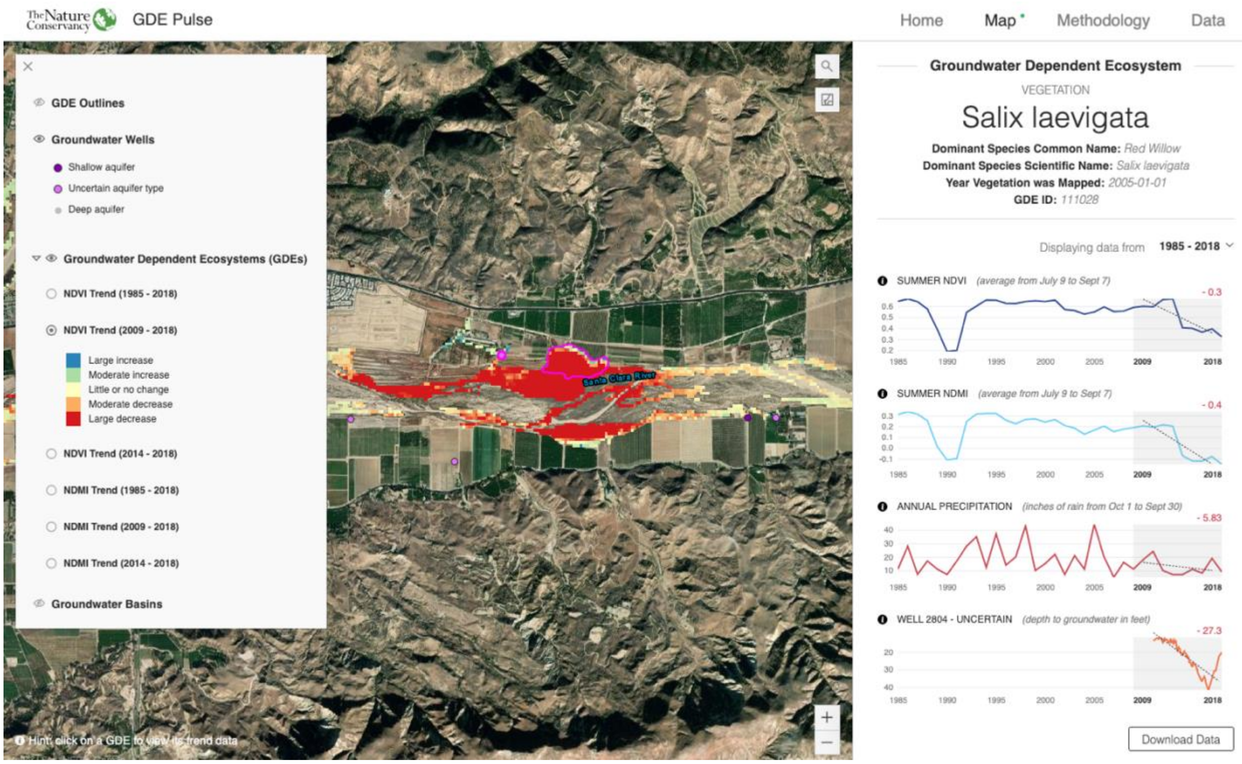
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

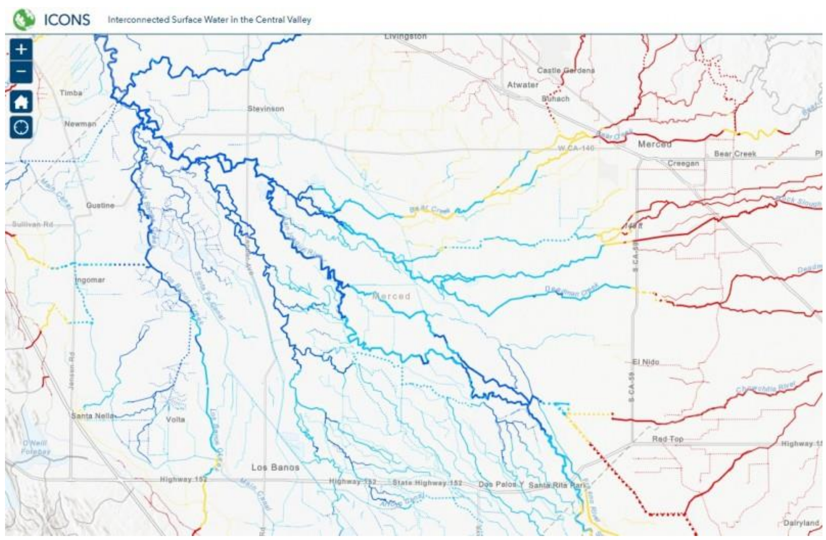
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the San Luis Obispo Valley

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the San Luis Obispo Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas cyanoptera	Cinnamon Teal			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Anas discors	Blue-winged Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas platyrhynchos	Mallard			
Anas platyrhynchos	Mallard			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea alba	Great Egret			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Botaurus lentiginosus	American Bittern			
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chen rossii	Ross's Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cistothorus palustris palustris	Marsh Wren			
Egretta thula	Snowy Egret			

Egretta thula	Snowy Egret			
Egretta thula	Snowy Egret			
Fulica americana	American Coot			
Fulica americana	American Coot			
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinago delicata	Wilson's Snipe			
Grus canadensis	Sandhill Crane			
Himantopus mexicanus	Black-necked Stilt			
Himantopus mexicanus	Black-necked Stilt			
Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Numenius americanus	Long-billed Curlew			
Nycticorax nycticorax	Black-crowned Night-Heron			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalacrocorax auritus	Double-crested Cormorant			
Phalacrocorax auritus	Double-crested Cormorant			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Plegadis chihi	White-faced Ibis		Watch list	

Pluvialis squatarola	Black-bellied Plover			
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Crangonyx spp.	Crangonyx spp.			
Cyprididae fam.	Cyprididae fam.			
Gammarus spp.	Gammarus spp.			
Hyalella spp.	Hyalella spp.			
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus mykiss - SCCC	South Central California coast steelhead	Threatened	Special Concern	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC

Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
INSECTS & OTHER INVERTS				
Agabus spp.	Agabus spp.			
Antocha spp.	Antocha spp.			
Apedilum spp.	Apedilum spp.			
Atractelmis wawona	Wawona Riffle Beetle		Special	
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Blepharicera spp.	Blepharicera spp.			
Brillia spp.	Brillia spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Ephydridae fam.	Ephydridae fam.			
Eubrianax edwardsii				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Helochares normatus				Not on any status lists
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			

Hydroptila spp.	Hydroptila spp.			
Laccobius spp.	Laccobius spp.			
Lepidostoma spp.	Lepidostoma spp.			
Marilia flexuosa	A Caddisfly			
Maruina lanceolata				Not on any status lists
Micrasema spp.	Micrasema spp.			
Micropsectra spp.	Micropsectra spp.			
Microtendipes spp.	Microtendipes spp.			
Narpus angustus				Not on any status lists
Ochthebius spp.	Ochthebius spp.			
Optioservus spp.	Optioservus spp.			
Ordobrevia nubifera				Not on any status lists
Parametriocnemus spp.	Parametriocnemus spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Simuliidae fam.	Simuliidae fam.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sperchontidae fam.	Sperchontidae fam.			
Sympetrum madidum	Red-veined Meadowhawk			
Tanytarsus spp.	Tanytarsus spp.			
Tinodes spp.	Tinodes spp.			
Tricorythodes spp.	Tricorythodes spp.			
Tvetenia spp.	Tvetenia spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Ferrissia spp.	Ferrissia spp.			
Hydrobiidae fam.	Hydrobiidae fam.			
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Valvata spp.	Valvata spp.			
PLANTS				
Cirsium fontinale obispoense	Chorro Creek Bog Thistle	Endangered	Endangered	CRPR - 1B.2

Eryngium aristulatum hooveri	Hoover's Coyote-thistle		Special	CRPR - 1B.1
Cirsium fontinale obispoense	Chorro Creek Bog Thistle	Endangered	Endangered	CRPR - 1B.2
Cotula coronopifolia	NA			
Eryngium aristulatum hooveri	Hoover's Coyote-thistle		Special	CRPR - 1B.1
Eryngium aristulatum hooveri	Hoover's Coyote-thistle		Special	CRPR - 1B.1
Persicaria punctata	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Psilocarphus tenellus	NA			
Psilocarphus tenellus	NA			
Salix breweri	Brewer's Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Veronica anagallis-aquatica	NA			
Veronica anagallis-aquatica	NA			
Veronica anagallis-aquatica	NA			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

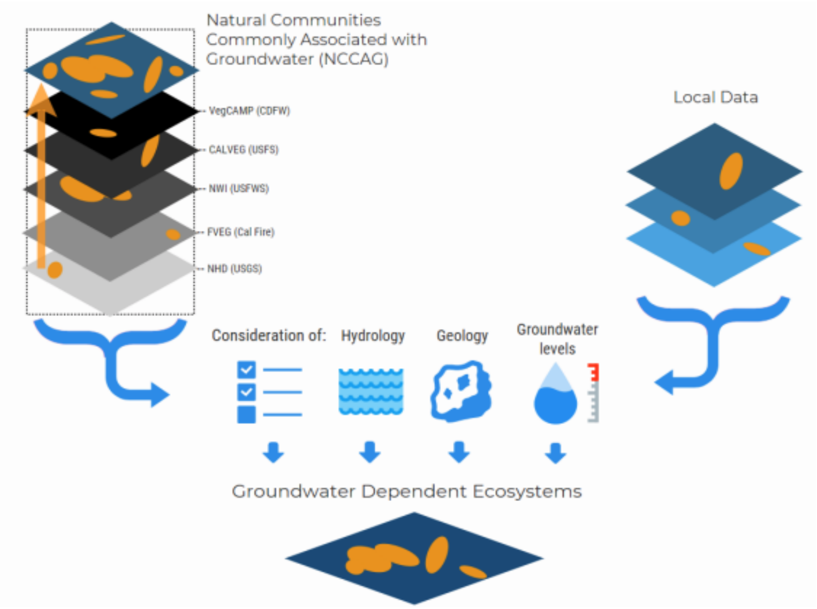


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

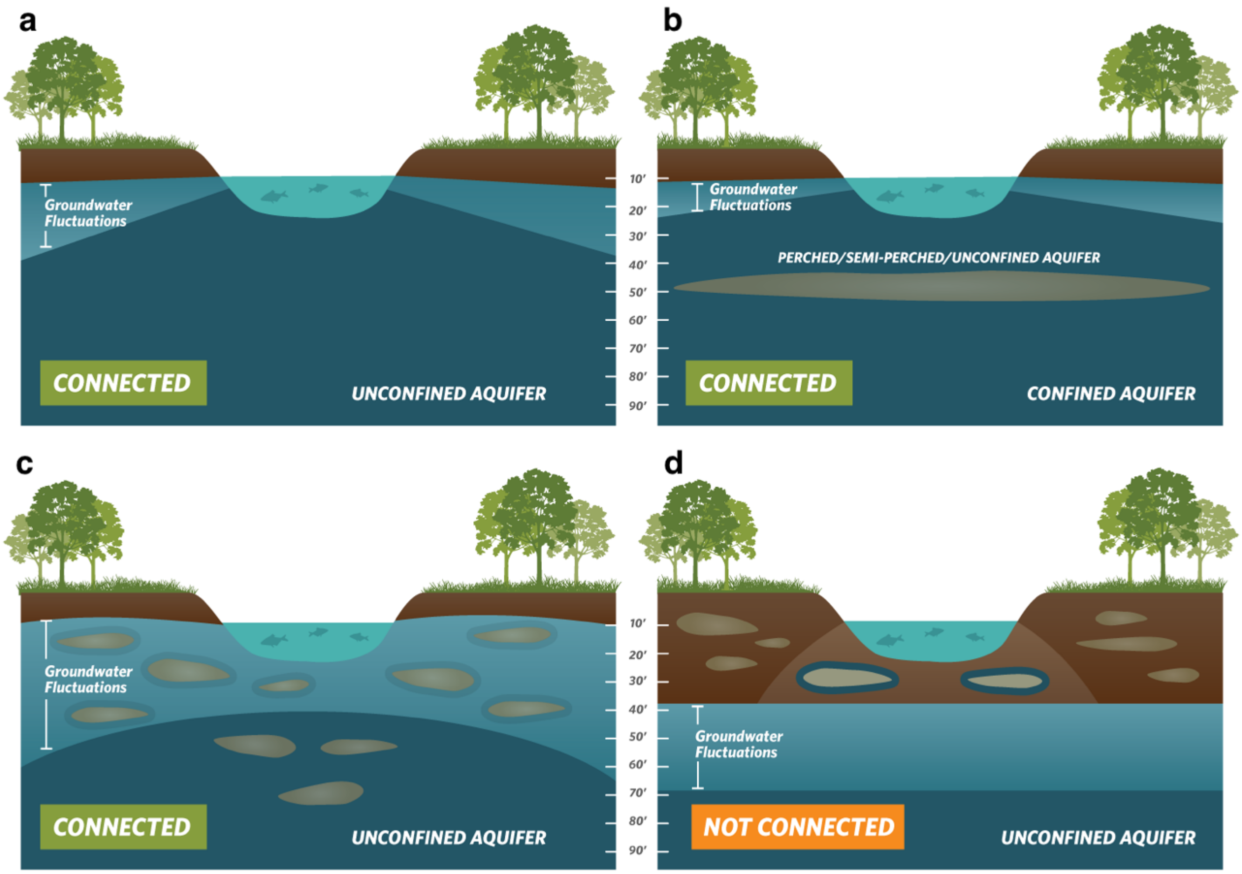

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

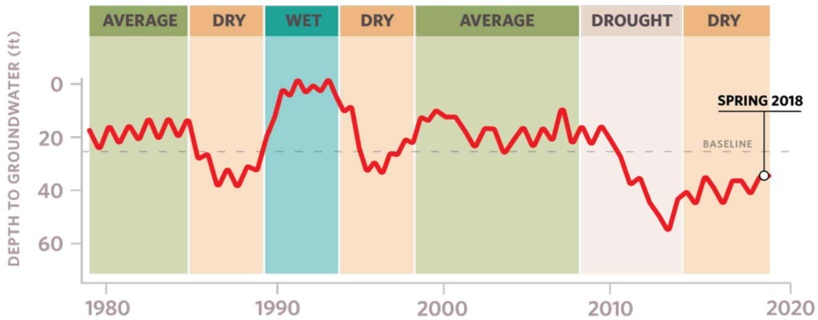

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

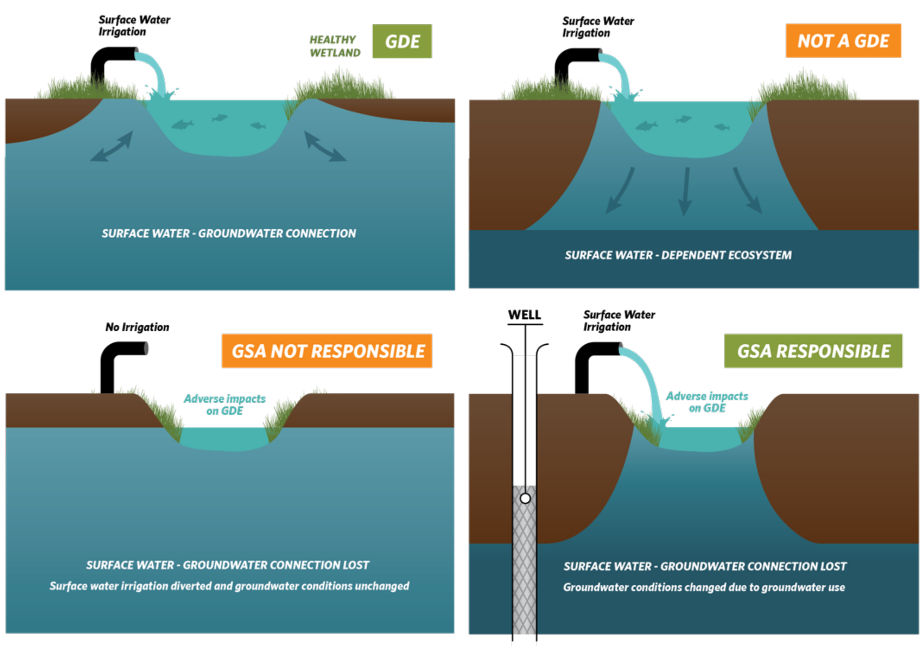

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

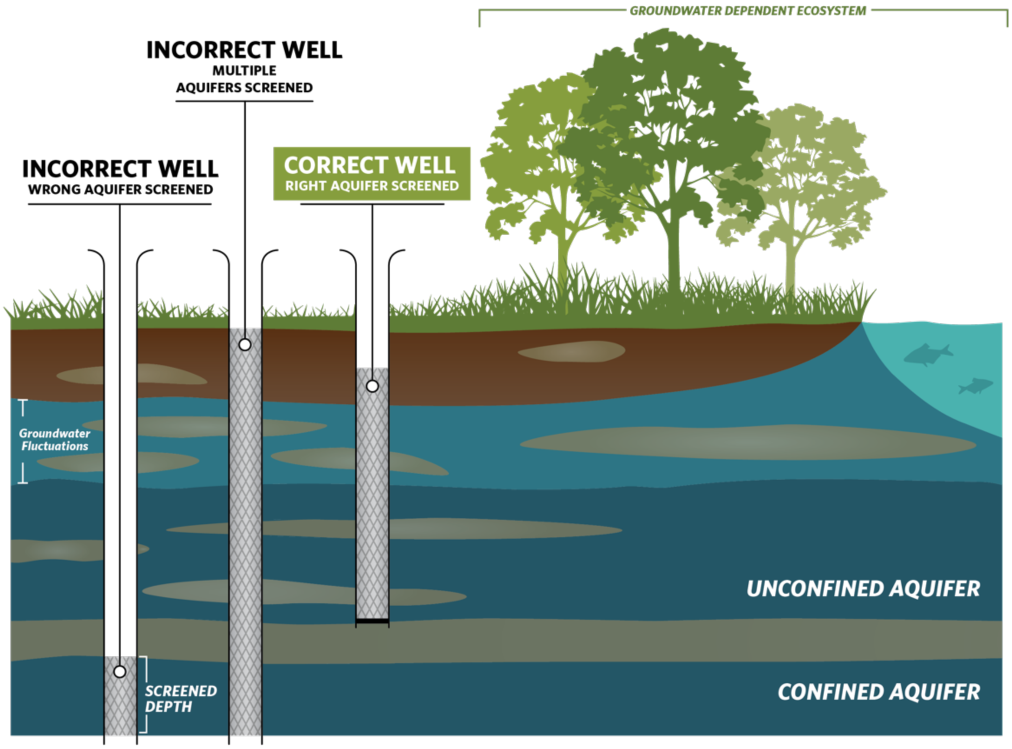

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

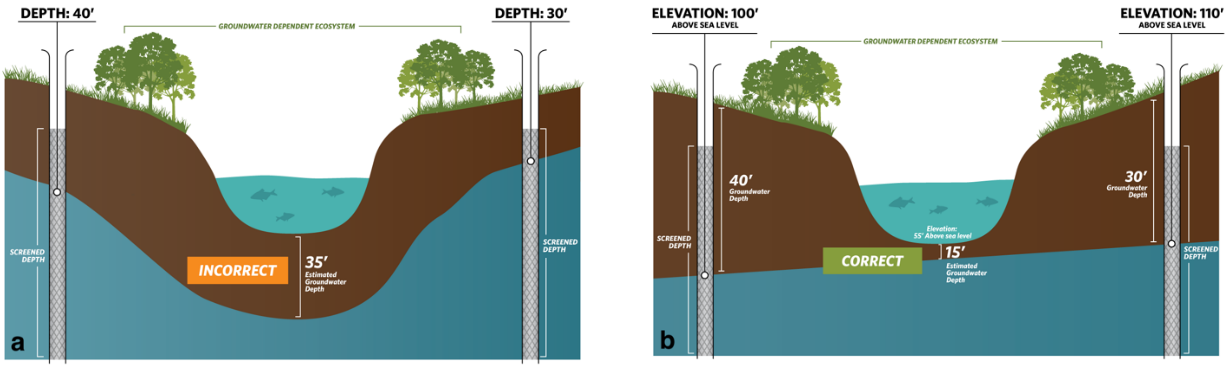

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

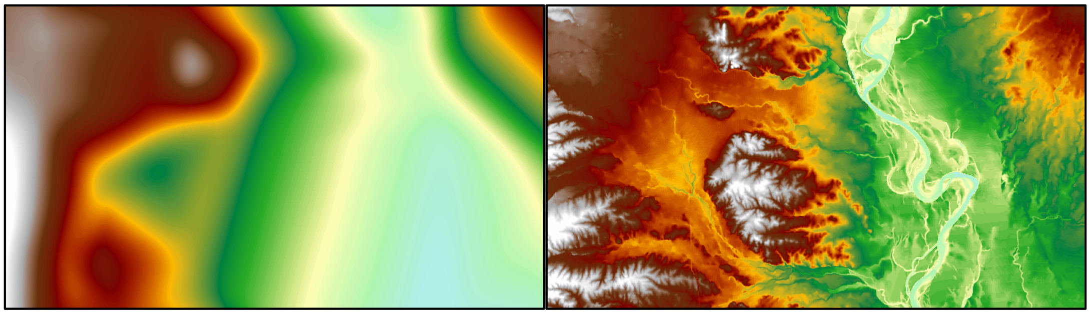

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

August 10, 2021

San Pasqual Valley Groundwater Sustainability Agency
1600 Pacific Highway
San Diego, CA 92101

Submitted via email: KDanek@sandiego.gov

Re: Public Comment Letter for the San Pasqual Valley Groundwater Basin Draft GSP

Dear Karina Danek,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the San Pasqual Valley Groundwater Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the San Pasqual Valley Groundwater Basin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the San Pasqual Valley Groundwater Basin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. The DWR DAC mapping tool indicates that there are no DACs in the basin, however this is not stated in the GSP. We commend the GSA for including a map of the density of domestic wells in the basin (Figure 2-8). The GSP should be further improved by including a map of individual domestic well locations and by indicating the population dependent on groundwater for their source of drinking water.

RECOMMENDATIONS
• State definitively that there are no DACs in the basin, instead of being silent on the subject. Indicate what source was used to make the determination (e.g., the DWR DAC mapping tool). • Include a map of individual domestic well locations and a table of well data showing screen depths. Indicate the population dependent on groundwater for their source of drinking water. • Describe the occurrence of tribal lands in the basin. The GSP states that there are no tribal lands in the basin, but includes a tribe member from the San Pasqual Tribe on the Advisory Committee. If the San Pasqual Tribe has interests in the basin, describe them in detail.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**. The GSP uses a numerical model to analyze surface water and groundwater interactions. A short description of the ISW analysis is provided in the GSP, but very little detail or background on the approach is given. For example, the location and spatial resolution of groundwater elevation data (e.g., how close the wells are to the streams) behind the numerical model is not provided. Additionally, the temporal resolution of groundwater elevation data (e.g., number of years and seasonality) that parameterizes the numerical model is also unclear.

The GSP states that reaches identified as disconnected are in portions of the basin where depth to groundwater has been greater than 30 feet since 2015. The GSP does not, however, provide justification for the 30 feet criteria provided in the text.

RECOMMENDATIONS
● Overlay the figure of stream surface water depletion (Figure 4-33) with depth-to-groundwater contour maps to illustrate the groundwater depths and groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis. Use depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth and capture the variability in environmental conditions inherent in California's climate. ● For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. ● Describe data gaps for the ISW analysis. Discuss and reconcile these data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **incomplete**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). We commend the GSA for including a comprehensive list of the state and federally threatened and endangered species in the basin (Table 1 of Appendix J). However, we found that some mapped features in the NC dataset were improperly disregarded, as described below.

- GDEs were incorrectly removed based on groundwater levels that were greater than 30-ft in 2015, a single point in time. This is a technically incorrect approach since groundwater levels fluctuate over seasonal and interannual time scales due to California's Mediterranean climate and intensifying flood and drought events due to climate change. Justifying the removal of NC dataset polygons solely based on this criterion does not acknowledge that groundwater levels temporally vary and the fact that many plant species within GDEs can access groundwater depths beyond 30-feet or have adapted water stress strategies to deal with intermittent periods of deep groundwater levels. Using this methodology disregards groundwater fluctuations and may result in the omission of ecosystems that are groundwater dependent.
- GDEs were disregarded based on the presence or proximity of surface water. However, partial reliance on surface water does not necessarily prove that the plants and animals do not access groundwater. Many GDEs often simultaneously rely on multiple sources of water (i.e., both groundwater and surface water), or shift their reliance on different sources on an interannual or inter-seasonal basis. Additionally, adverse impacts can occur to GDEs due to pumping that further separates groundwater from surface water.

- The GDE identification process utilized aerial imagery in an incorrect manner. The GSP relied on aerial imagery to detect surface water, and then made the assumption that only GDEs present in inundated or saturated areas were connected to groundwater. This approach is incorrect for two reasons: 1) not all surface water is connected to groundwater, and 2) visually inspecting aerial imagery cannot detect groundwater occurring near the ground surface. GDEs can rely on groundwater for some or all its water requirements, whether or not surface water is present. In California, GDE reliance on groundwater often vary by season, and depend on the availability of alternative water sources (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow).

RECOMMENDATIONS

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.
- Use depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.
- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network. While the GSP acknowledges that some locations that may be GDEs are not confirmed as GDEs (and their status is uncertain), they are mapped as non-GDEs. These should be mapped as potential GDEs.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included into the water budget. The integration of these ecosystems into the water budget is **insufficient**. The water budget did not include the current, historical, and projected demands of native vegetation and managed wetlands. The omission of explicit water demands for native vegetation and managed wetlands is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

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[1] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[2] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

RECOMMENDATION

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation and managed wetlands.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **incomplete**. SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the Notice and Communication section of the GSP (Section 1.4). We note the following deficiencies with the overall stakeholder engagement process.

- The opportunities for public involvement and engagement are described in very general terms. They include attendance at public meetings, stakeholder email list, and updates to the San Pasqual Valley GSP website.

- Very little information was provided on the level of engagement of the Advisory Committee and the Technical Peer Review Group. While the members of the Advisory Committee are provided in Table 1-2, the members of the Technical Peer Review Group are not listed.

RECOMMENDATIONS

- Include a robust Stakeholder Communication and Engagement Plan.

- Conduct active and targeted outreach to engage domestic well owners, environmental stakeholders, and tribal stakeholders during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders.

- Describe the occurrence of tribal lands in the basin. Explain the inclusion of a tribe member from the San Pasqual Tribe on the Advisory Committee. The GSP states that there are no tribal lands in the basin, but includes a tribe member from the San Pasqual Tribe on the Advisory Committee. If the San Pasqual Tribe has interests in the basin, describe them in detail.

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[3] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[4] and establishing minimum thresholds[5,6]

Disadvantaged Communities and Drinking Water Users

There are no DACs in the basin, according to the DWR DAC mapping tool. The GSP has taken initial steps to define SMC for domestic wells owners. The GSP analyzes direct or indirect impacts on domestic wells when defining undesirable results for chronic lowering of groundwater levels and degraded water quality by describing impacts to potable supply of drinking water for domestic well users. However, the SMC developed for domestic well owners can be improved with the following recommendations.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Further describe the impact of passing the minimum threshold for domestic well owners. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.

Degraded Water Quality

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for TDS and nitrate on domestic water users.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Minimum thresholds for chronic lowering of groundwater levels are set to historical low groundwater elevations in proximity to potential GDEs, and are allowed to fall to 50% of the historical range below historical minimums where potential GDEs are not present. Based on the GSP's assessment that historic levels have been sustainable, the GSP states that using these levels as a minimum threshold should not pose a harmful impact to GDEs.

However, the true impacts to ecosystems under this scenario are not discussed. If minimum thresholds are set to historic low groundwater levels and the basin is allowed to operate just above or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring in 2015, at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse.

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[4] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[5] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[6] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

While ecosystems may have been only water stressed in 2015, they can be inadvertently destroyed if groundwater conditions are maintained just above those 2015 levels in the long-term, since the basin would be permitted to sustain extreme dry conditions over multiple seasons and years.

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, water quality, and depletions of interconnected surface waters, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[7] in the basin. Defining undesirable results is the crucial first step before the minimum thresholds[8] can be determined.

- For the interconnected surface water SMC, the undesirable results should include a description of potential impacts on instream habitats within ISWs when defining minimum thresholds in the basin[9]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,10].

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[11] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

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[7] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[8] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[9] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[10] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[11] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using a climate transient analysis. However, the GSP did not consider multiple climate scenarios (e.g., the 2070 wet and 2070 extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

The GSP included climate change into key inputs (precipitation, evapotranspiration, and surface water flow) of the projected water budget. However, the GSP does not calculate a sustainable yield based on the projected water budget with climate change incorporated, and in fact does not present a sustainable yield for any time period. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, and sustainable yield is not calculated, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extreme wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**. Our comments above note data gaps in the monitoring networks for GDEs and ISWs. The lack of monitoring wells and/or the lack of plans for future monitoring threatens GDEs, aquatic habitats, and surface water users. Appropriate monitoring is necessary so that groundwater conditions within GDEs and ISWs are characterized and surface-shallow groundwater interactions are fully integrated into the GSP. GDEs and ISWs will remain unprotected by the GSP without adequate monitoring and identification of data gaps. The Plan therefore fails to meet SGMA's requirements for the monitoring network[12].

[12] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

RECOMMENDATIONS

- Provide maps that overlay monitoring well locations with the locations of domestic wells to clearly identify potentially impacted areas.
- Include plans to reconcile data gaps for GDEs and ISWs in the GSP now, instead of leaving this for a future project to be implemented when a groundwater level trigger is reached. Evaluate how the gathered data will be used to identify and map GDEs and ISWs.
- Determine what ecological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**.

The GSP states that because the basin is sustainable, project and management actions will only be implemented as necessary in the future. However, groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for all beneficial users. Environmental beneficial users such as GDEs, aquatic habitats, and surface water users were not sufficiently identified in the GSP. Therefore, potential project and management actions to be implemented sometime in the future may not protect these beneficial users.

The GSP presents tiers for the projects and management actions in Figure 9-2. Tier 0 projects and management actions are to be implemented by the GSA during GSP implementation. Future tiers are triggered by increasingly severe minimum threshold exceedances. The GDE study is proposed as a Tier 1 Project and Management Action. Because of the data gaps noted for GDEs above, this study should be included in the GSP now, not set aside for future implementation.

RECOMMENDATIONS

- For GDEs and ISWs, recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the “Multi-Benefit Recharge Project Methodology Guidance Document”[13].

[13] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

- For domestic well owners, include discussion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

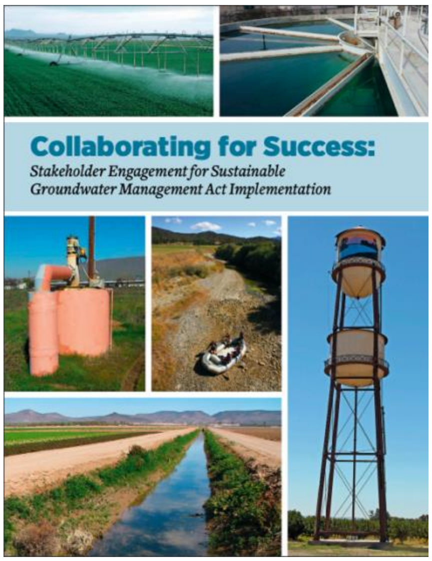
- For domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

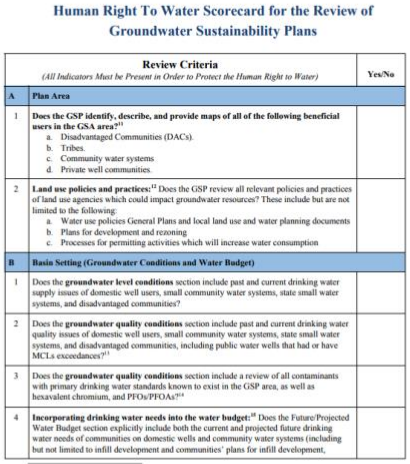
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

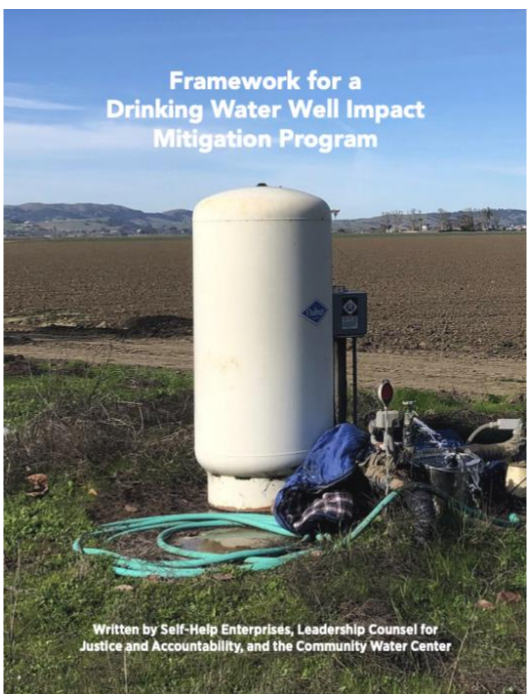


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

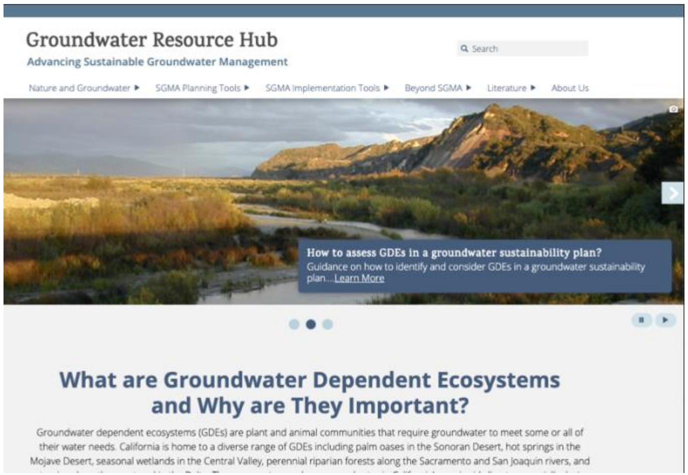
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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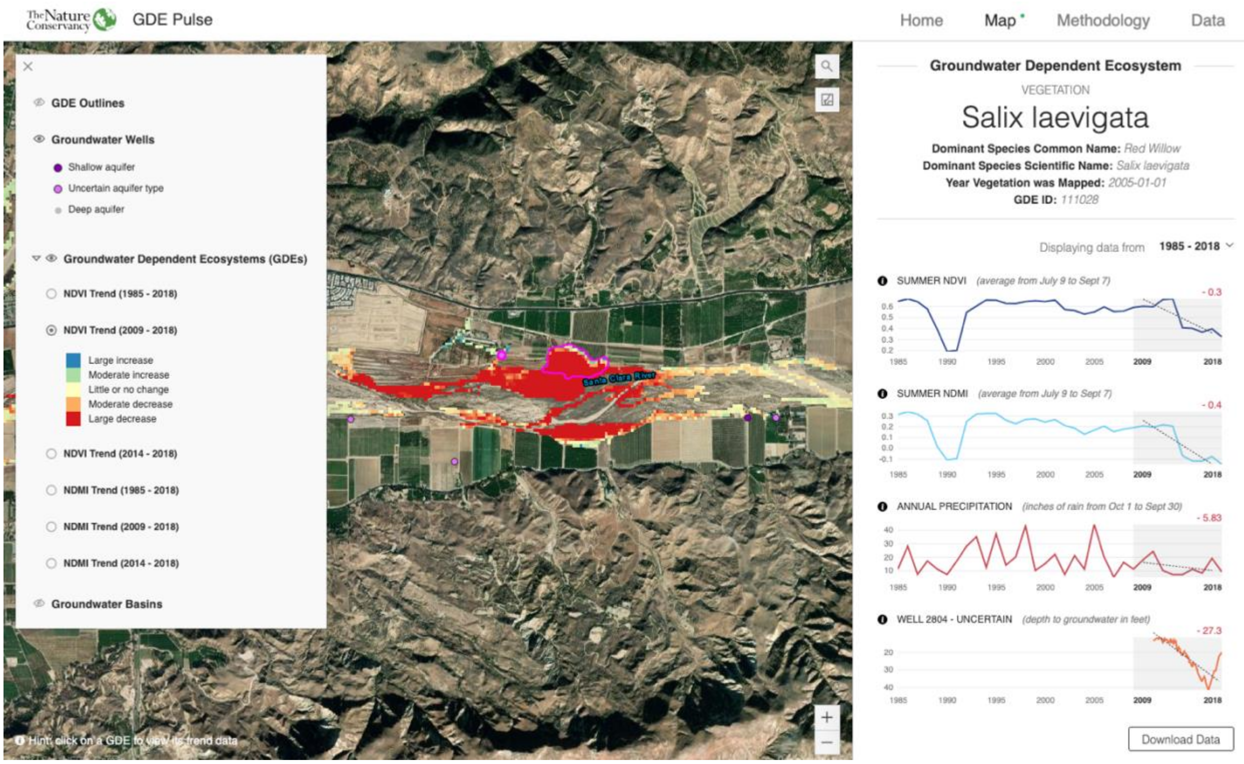
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

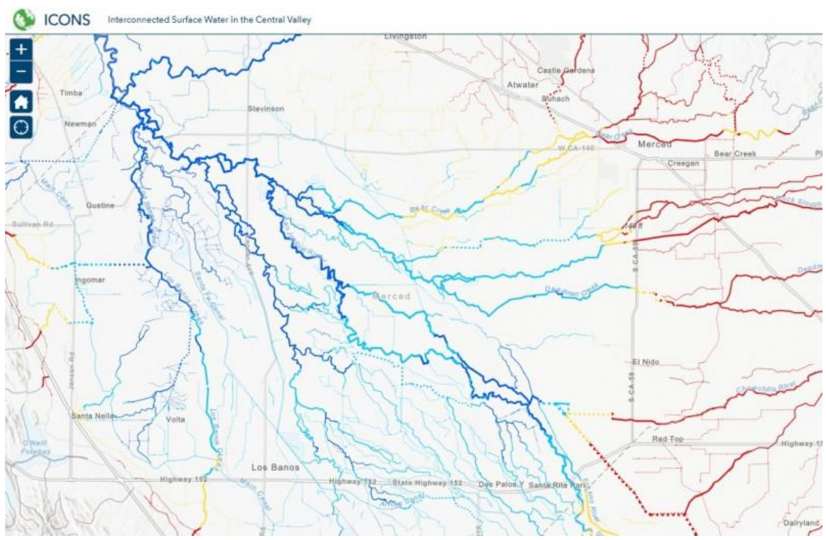
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data [available online](#) from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the San Pasqual Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the San Pasqual Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya collaris	Ring-necked Duck			
Aythya valisineria	Canvasback		Special	
Butorides virescens	Green Heron			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Egretta thula	Snowy Egret			
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Plegadis chihi	White-faced Ibis		Watch list	
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Vireo bellii	Bell's Vireo			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern	ARSSC
Pseudacris cadaverina	California Treefrog			ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Libellula saturata	Flame Skimmer			
Pachydiplax longipennis	Blue Dasher			
Perithemis intensa	Mexican Amberwing			

Rhionaeschna multicolor	Blue-eyed Darner			
Tramea lacerata	Black Saddlebags			
PLANTS				
Lemna turionifera	Turion Duckweed			
Salix laevigata	Polished Willow			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

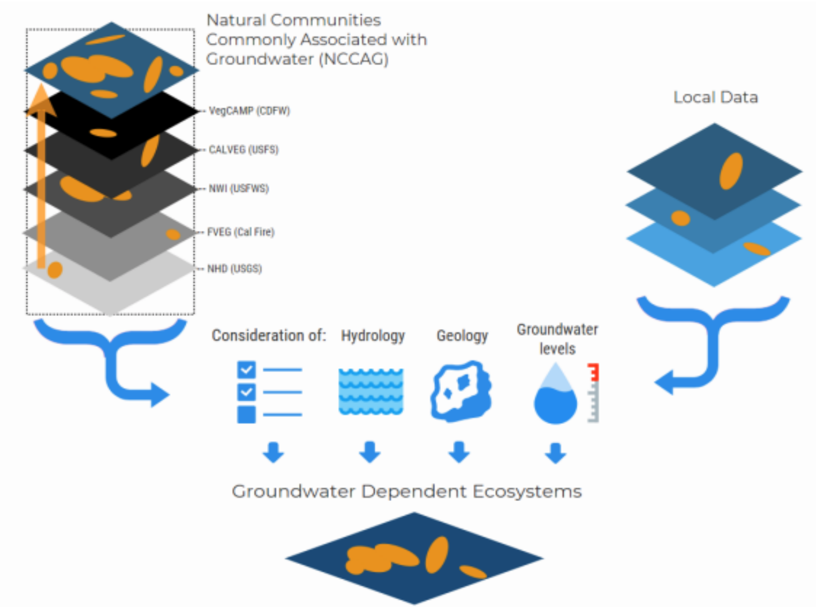


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

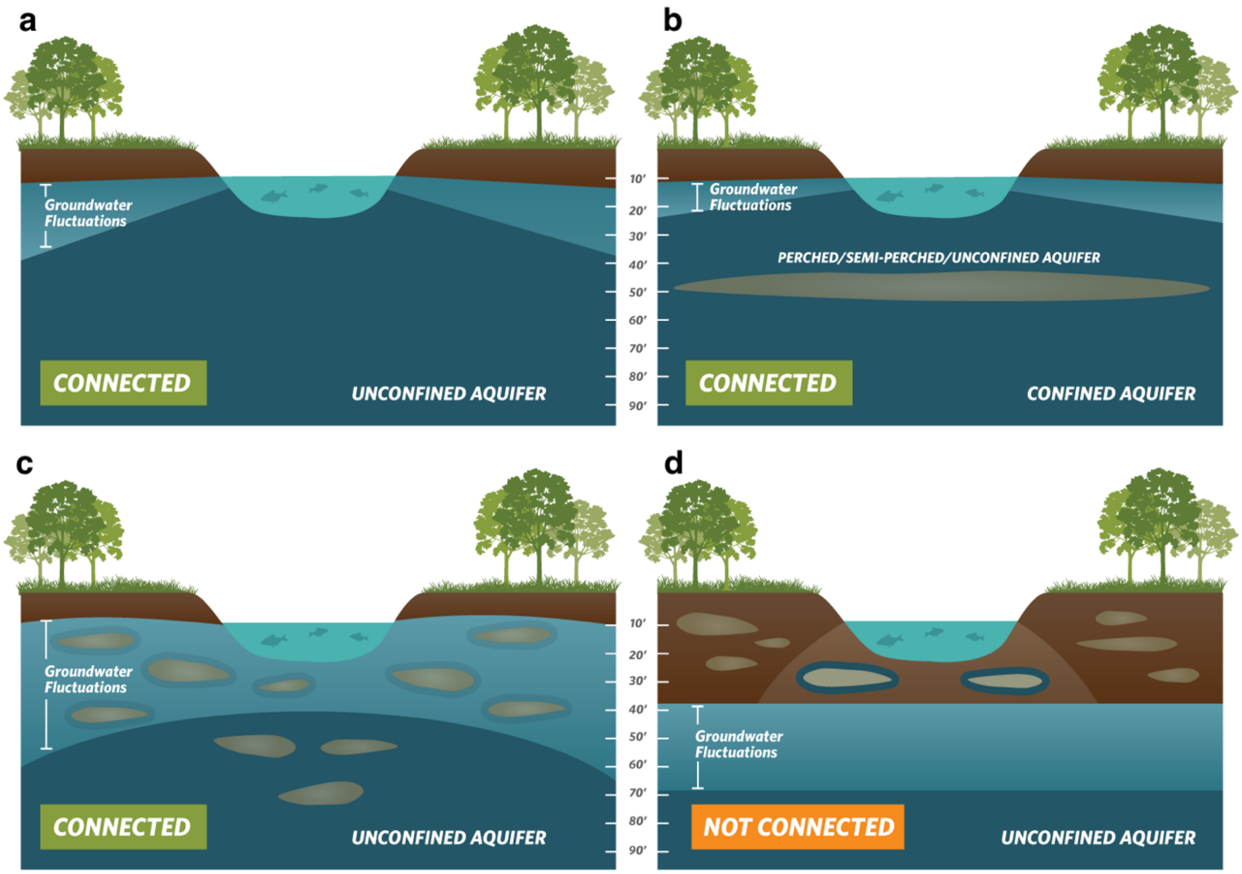

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

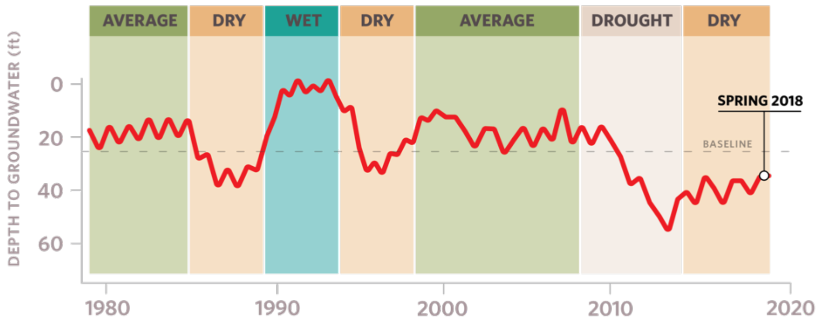

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

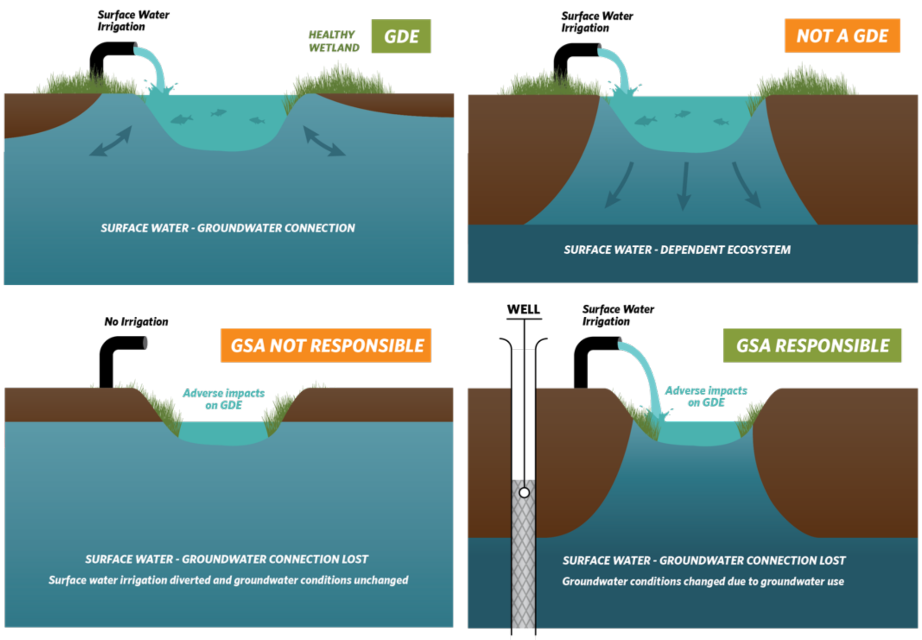

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

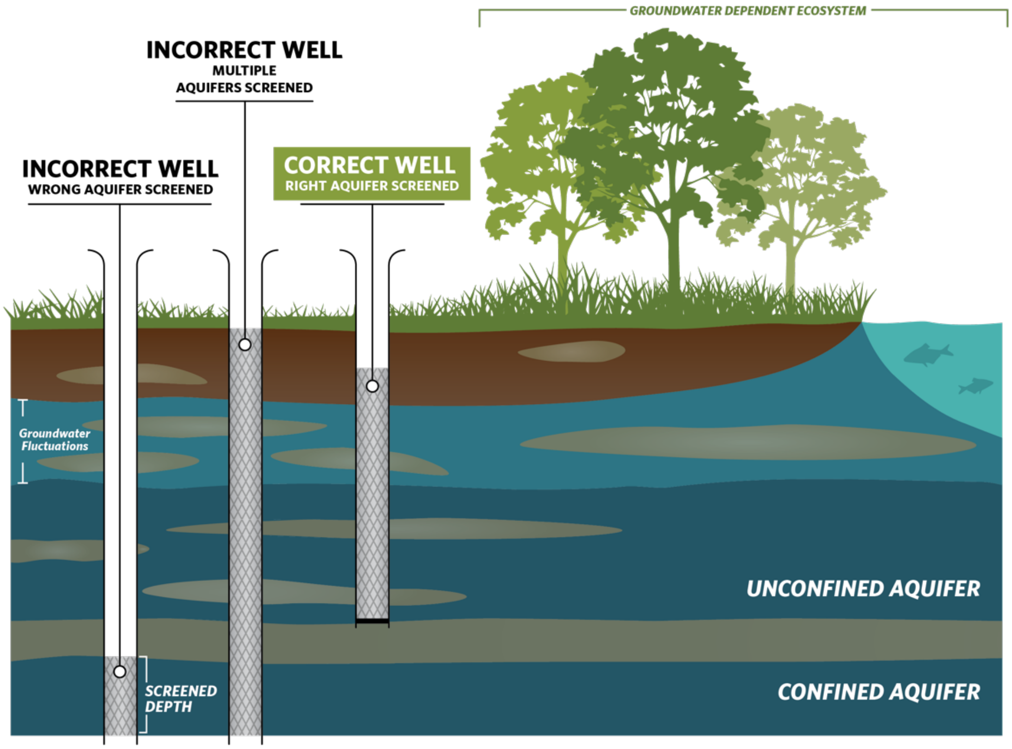

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

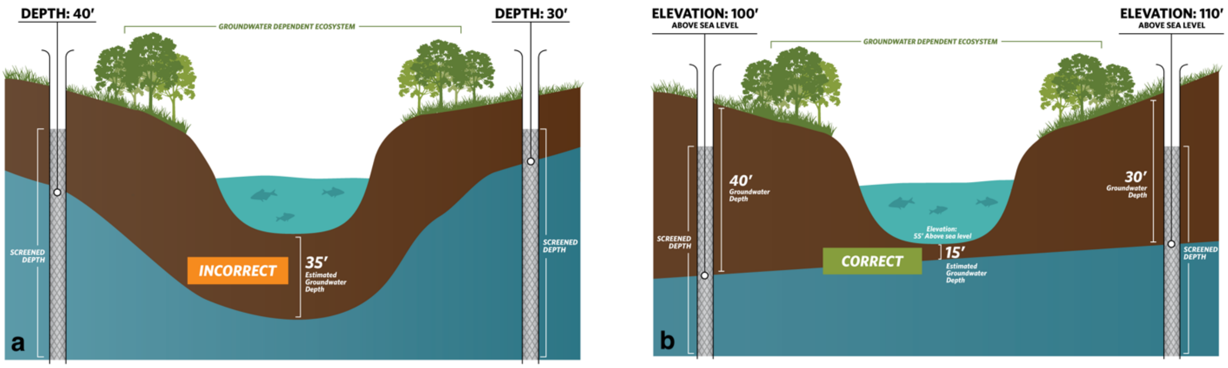

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

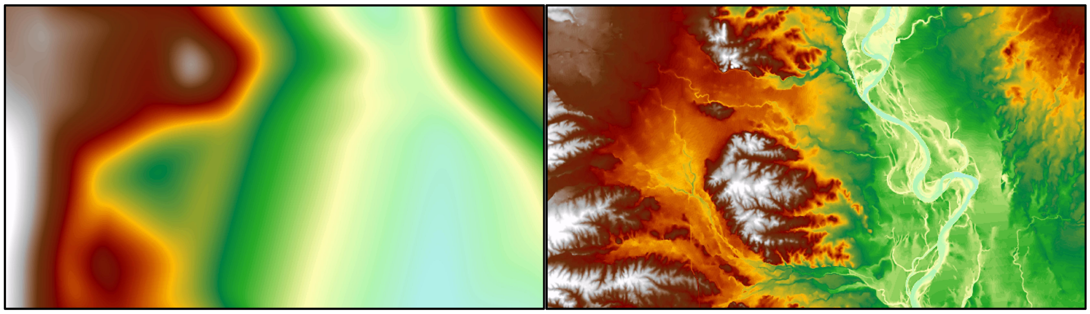

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

October 15, 2021

Santa Clarita Valley GSA
27234 Bouquet Canyon Road
Santa Clarita, CA 91350
Submitted via email: lparisi@gsiws.com; lcogan@gsiws.com

Re: Public Comment Letter for Santa Clara River Valley East Subbasin Draft GSP

Dear Laura Parisi,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Santa Clara River Valley East Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Santa Clara River Valley East Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Santa Clara River Valley East Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. We note the following deficiencies with the identification of these key beneficial users.

- The GSP fails to identify and map the locations of DACs, and describe the size of each DAC population within the subbasin.
- The GSP provides a map of domestic well density in Figure 3-6, but fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.
- The GSP fails to identify the population dependent on groundwater as their source of drinking water in the subbasin. Specifics are not provided on how much each DAC community relies on a particular water supply (e.g., what percentage is supplied by groundwater).

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Describe and map the locations of DACs and provide the size of each DAC population. The DWR DAC mapping tool[1] can be used for this purpose. • Include a map showing domestic well locations and average well depth across the subbasin. • Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

[1] The DWR DAC mapping tool is available online at: https://gis.water.ca.gov/app/dacs/

Interconnected Surface Waters
The identification of Interconnected Surface Waters (ISW) is **sufficient**. We commend the GSA for their comprehensive analysis of ISWs in the subbasin. The plan used groundwater well hydrographs, river thalweg elevation data, and precipitation data to assess six individual reaches of the Santa Clara River to describe characteristics of each. The GSP presents three separate maps that indicate the nature of surface water and groundwater exchanges along the Santa Clara River during wet, normal, and dry climatic conditions. The terms potentially gaining and potentially losing are used to describe each of the six reaches for each of the three climatic conditions.

The GSP states (p. 5-54): *"The river is interconnected directly with the Alluvial Aquifer, primarily in the western and central portions of the Basin. The river also has an indirect connection with the Saugus Formation in the western portion of the Basin, which is an area where the Saugus Formation is discharging its water into the Alluvial Aquifer, and thereby providing an upwards driving force for groundwater to discharge into the Santa Clara River in certain localized reaches west of I-5 at certain times."* The GSP does not provide an overall map showing the interconnected and disconnected reaches. Note the regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

RECOMMENDATION
● In addition to the maps showing gaining and losing reaches, provide an additional map that shows interconnected and disconnected reaches. State clearly in the text that losing reaches do not equate to disconnected reaches.

Groundwater Dependent Ecosystems
The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources. However, we found that mapped features in the NC dataset were improperly disregarded. NC dataset polygons were incorrectly removed in areas adjacent to irrigated fields or in floodplains due to the presence of surface water. However, this removal criteria is flawed since GDEs, in addition to groundwater, can rely on multiple water sources – including flood flows or shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields – simultaneously and at different temporal/spatial scales. NC dataset polygons adjacent to irrigated land or in floodplains can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on this factor.

To analyze GDEs based on groundwater levels, the GSP states that (p. 5-95) *"data is taken conservatively from modeled groundwater depths throughout the Basin in the late dry season (September) during a wet year (2011)."* We recommend using groundwater data from multiple seasons and water year types to determine the range of depth to groundwater around NC dataset polygons. Other groundwater data used to assess GDEs is not clearly presented. Table 5-6 presents the locations and the historical low groundwater levels of GDE monitoring wells (GDE-A through GDE-E). However, on Figure 7-14 (Section 7.3.8.2), wells GDE-A through GDE-E are labeled "New Observation Well (to be constructed)".

We commend the GSA for including an inventory of flora and fauna species and habitat types in the subbasin's GDEs. Table 5-4 presents a general description of each segment of the Santa Clara River, including GDEs and flora species. Table 5-5 presents a summary of the potential GDEs, including vegetation classification. Special status fauna are discussed in riparian habitat (5.3.1.3) and aquatic habitat (5.3.1.4).

RECOMMENDATIONS

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.
- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape.
- Clear up the conflicting information in the GSP about GDE monitoring wells (GDE-A through GDE-E). Table 5-6 presents the locations and the historical low groundwater levels of these wells. However, Figure 7-14 (Section 7.3.8.2) labels wells GDE-A through GDE-E as "New Observation Well (to be constructed)".
- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[2,3] to be included in the water budget. The integration of native vegetation into the water budget is **sufficient**. We commend the GSA for including the groundwater demands of this ecosystem in the historical, current and projected water budgets. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the subbasin.

RECOMMENDATION

- State whether or not there are managed wetlands in the subbasin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

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2 "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

3 "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders[4] is not fully met by the description in the Communications & Engagement Plan (Appendix N). We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms. They include public notices, opportunities for public comments provided at GSA board meetings and hearings, and attendance at public workshops. There is no specific outreach described for DACs or domestic well owners, or a plan for public engagement during the GSP's implementation phase.
- The Communications & Engagement Plan does not include outreach and engagement that is specifically directed to environmental stakeholders during the GSP's development or implementation phases.

RECOMMENDATION
● Include a more detailed and robust Communications & Engagement Plan that describes active and targeted outreach to engage DACs, domestic well owners, and environmental stakeholders during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[5] and establishing minimum thresholds.[6,7]

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[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

[5] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[6] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[7] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Disadvantaged Communities and Drinking Water Users
For chronic lowering of groundwater levels, the GSP does not analyze direct and indirect impacts on DACS or drinking water users when defining undesirable results, or evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

For degraded water quality, the GSP identifies the following as natural constituents of concern (COCs): nitrate, total dissolved solids (TDS), chloride, and sulfate. The GSP identifies the following as anthropogenic COCs: perchlorate, trichloroethylene (TCE), tetrachloroethylene (PCE), chloroform, 1,1-dichloroethene, dichlorodiphenyltrichloroethane (DDT), polychlorinated biphenyls (PCBs), and per- and polyfluoroalkyl substances (PFAS).

The GSP states (p. 8-30): *"Minimum thresholds pertaining to salts and nutrients measured in groundwater are as follows: concentrations of TDS, chloride, nitrate, and sulfate that exceed WQOs and basin-wide assimilative capacity described in the 2016 SNMP in 20 percent of wells monitored in each management zone."* The GSP states that no minimum thresholds have been established for contaminants because state regulatory agencies, including LARWQCB and DTSC, have the responsibility and authority to regulate and direct actions that address contamination. However, in addition to coordinating with water quality regulatory programs, SMC should be established for all COCs in the subbasin impacted by groundwater use and/or management. Naturally occurring COCs can be exacerbated as a result of groundwater use or groundwater management within the subbasin.

For degraded water quality, the GSP only includes a very general discussion of impacts to DACs or drinking water users when defining undesirable results and evaluating the cumulative or indirect impacts of proposed minimum thresholds.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for chronic lowering of groundwater levels.
- Consider and evaluate the impacts of minimum thresholds and measurable objectives on DACs and drinking water users within the subbasin. Further describe the impact of reaching or passing the minimum threshold for these users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.

Degraded Water Quality

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."
- Set minimum thresholds and measurable objectives for water quality constituents within the subbasin including naturally occurring constituents that can be exacerbated as a result of groundwater use or groundwater management. Ensure they align with drinking water standards[8].

[8] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users.

<u>Groundwater Dependent Ecosystems and Interconnected Surface Waters</u>

The GSP sets minimum thresholds for chronic lowering of groundwater levels as the lowest groundwater elevation from the 95-year future-conditions model or lowest historically observed groundwater elevation in the modern era (i.e., since 1980), whichever is lower. The GSP states (p. 5-97): *"The existing GDEs have been sustained through a recent drought (2012–2016) that resulted in historically low groundwater levels. Table 5-6 summarizes the historical lows recorded in several representative locations along the river corridor. Figure 5-61 identifies these locations. When groundwater levels are above these recorded temporary historical lows, it can be inferred that GDEs are not significantly and unreasonably affected."* However, no evidence of GDE impacts during the 2012-2016 drought were provided. By assuming that GDEs can be sustained on historic low groundwater levels (or lower) and the subbasin is allowed to operate at or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the adverse impacts (such as widespread tree mortality or loss of critical habitat for steelhead) can exceed what had occurred prior to 2015.

Similarly, the GSP sets the minimum threshold for depletion of interconnected surface water as the surface water depletion caused by groundwater extraction as measured by groundwater levels falling below the lowest predicted future groundwater elevation measured at GDE-area monitoring wells. However, the true impacts to ecosystems under this scenario are not fully discussed in the GSP. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration). In fact, the GSP states (p. 8-43): *"Because the minimum thresholds are based on future predicted water levels and are lower than historical levels, a data gap exists regarding the actual response of GDEs to a groundwater elevation that is at or below the historical low water level but above the minimum threshold for interconnected surface water."*

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates, alterations in fish spawning/rearing/migration) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[9] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[10] can be determined.

- When establishing SMC for the basin, please consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs should include "impacts on groundwater dependent ecosystems".

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached[11]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface and groundwater as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,12].

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[13] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the GSP does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

We acknowledge the inclusion of climate change into key inputs (e.g., precipitation and evaporation) of the projected water budget. However, climate change was not incorporated into surface water flow inputs. The sustainable yield is calculated based on the projected pumping with climate change incorporated. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios

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[9] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[10] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[11] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]
[12] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf
[13] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

and projected climate change effects on surface water flow volumes, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS
• Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions. • Incorporate surface water flow inputs that are adjusted for climate change to the projected water budget. • Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations near DACs and domestic wells in the subbasin.

Figure 7-10 (Representative Monitoring Well Network for the Alluvial Aquifer) shows that no monitoring wells are located across portions of the subbasin near DACs and domestic wells (see maps provided in Attachment E). The representative monitoring network fails to represent groundwater conditions for DACs in the subbasin near the town of Newhall. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[14].

The GSP provides comprehensive discussion of data gaps for GDEs and ISWs in Section 7.3.7 (Interconnected Surface Water GDE Monitoring Network) and Section 9.5.1.1 (Installation of Piezometers within the GDE Area). The GSP discusses plans for GDE-related biological monitoring in Section 7.3.7.3 (GDE Monitoring) and Section 9.5.1.5 (Upland GDE Verification and Assessment).

RECOMMENDATIONS
• Provide maps that overlay current and proposed monitoring well locations with the locations of DACs and domestic wells to clearly identify potentially impacted areas. Increase the number of RMSs in the shallow aquifer across the subbasin as needed to adequately monitor all groundwater condition indicators. Prioritize proximity to DACs and drinking water users when identifying new RMSs.

[14] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

RECOMMENDATIONS

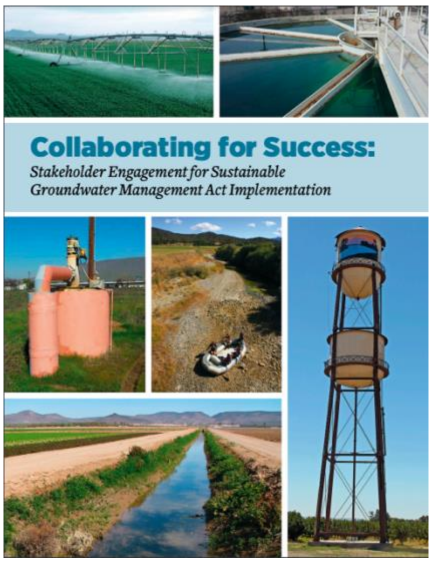
- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.
- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.
- The GSP discusses managed aquifer recharge projects. Note that recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[15].
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[15] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



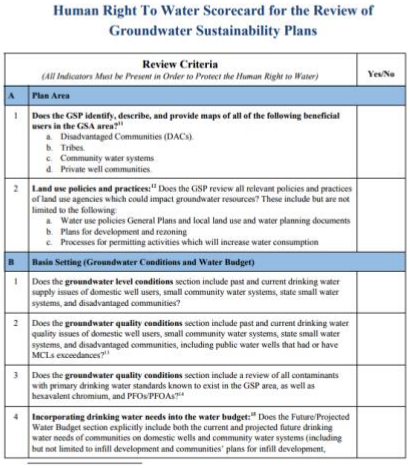
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

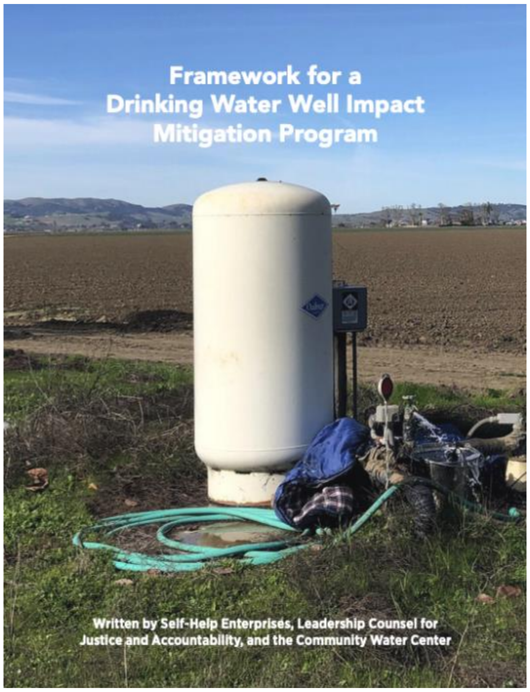


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

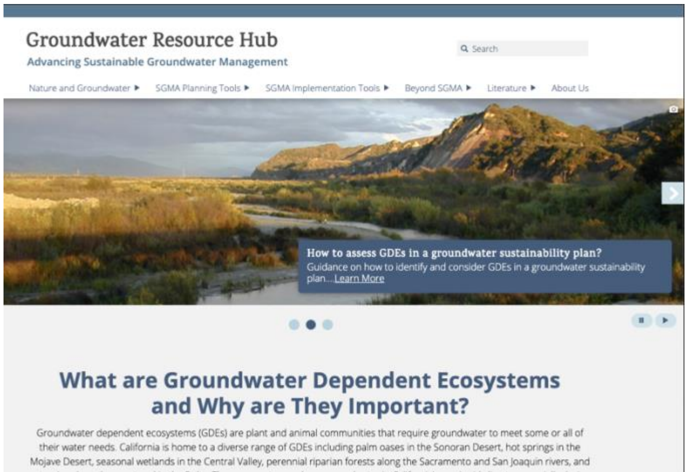
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



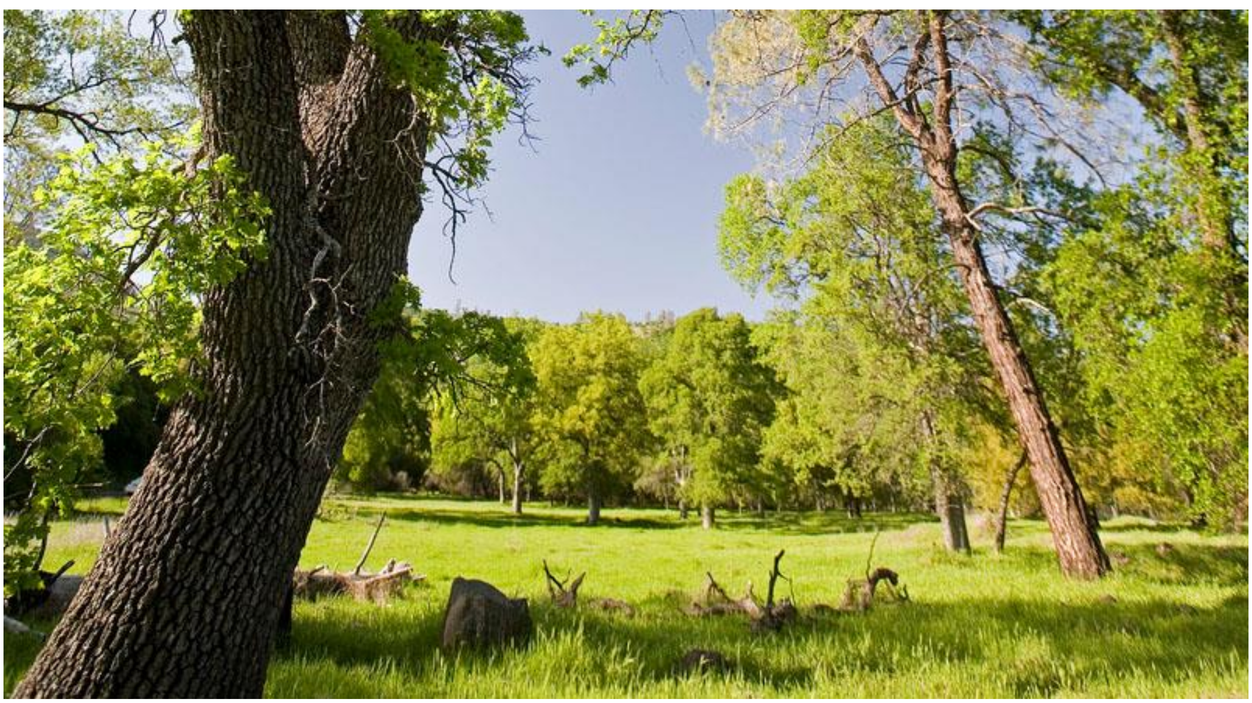
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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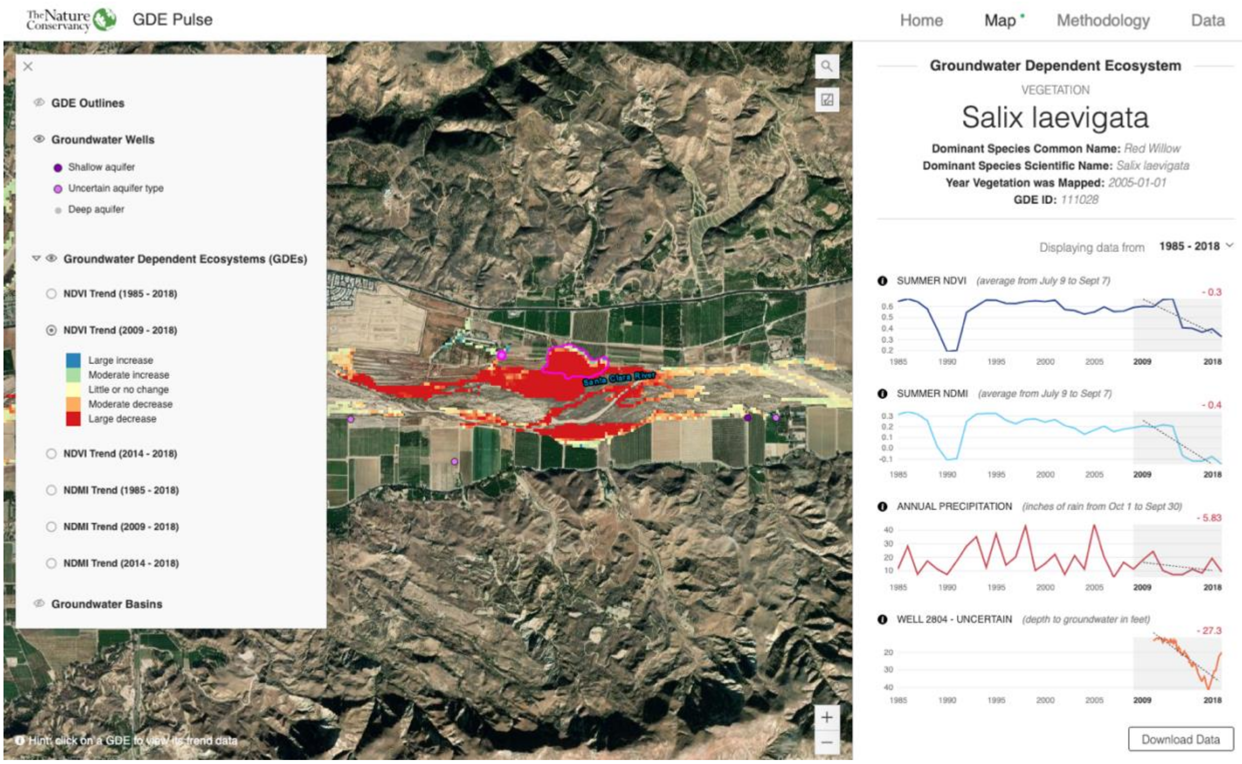
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

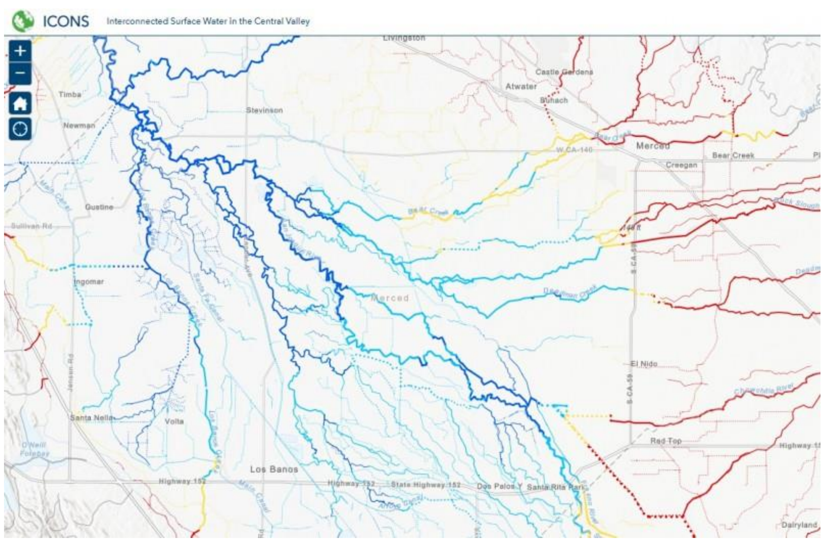
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1^{st} – September 30^{th}) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Santa Clara River Valley - Santa Clara River Valley East Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Santa Clara River Valley - Santa Clara River Valley East Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Cistothorus palustris palustris	Marsh Wren			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oreothlypis luciae	Lucy's Warbler		Special Concern	BSSC - Third priority
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			

Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Setophaga petechia brewsteri	A Yellow Warbler	Bird of Conservation Concern	Special Concern	
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Vireo bellii	Bell's Vireo			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Cambaridae fam.	Cambaridae fam.			
Cyprididae fam.	Cyprididae fam.			
Hyalella spp.	Hyalella spp.			
FISH				
Catostomus santaanae	Santa Ana sucker	Threatened	Special Concern	Endangered - Moyle 2013
Gasterosteus aculeatus williamsoni	Unarmored threespine stickleback	Endangered	Endangered	Endangered - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern	ARSSC
Pseudacris cadaverina	California Treefrog			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
INSECTS & OTHER INVERTS				
Abedus breviceps				Not on any status lists
Abedus spp.	Abedus spp.			
Aeshnidae fam.	Aeshnidae fam.			

Agapetus arcita	A Caddisfly			
Agapetus spp.	Agapetus spp.			
Alotanypus spp.	Alotanypus spp.			
Ambrysus spp.	Ambrysus spp.			
Ameletus spp.	Ameletus spp.			
Anax junius	Common Green Darner			
Anopheles spp.	Anopheles spp.			
Apedilum spp.	Apedilum spp.			
Argia agrioides	California Dancer			
Argia lugens	Sooty Dancer			
Argia sedula	Blue-ringed Dancer			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Belostomatidae fam.	Belostomatidae fam.			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Brillia flavifrons				Not on any status lists
Brillia spp.	Brillia spp.			
Callibaetis spp.	Callibaetis spp.			
Centroptilum spp.	Centroptilum spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corisella spp.	Corisella spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus annulator				Not on any status lists
Cricotopus bicinctus				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cricotopus trifascia				Not on any status lists
Cryptochironomus spp.	Cryptochironomus spp.			
Culoptila spp.	Culoptila spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Dytiscidae fam.	Dytiscidae fam.			
Enallagma praevarum	Arroyo Bluet			
Enallagma spp.	Enallagma spp.			
Endochironomus spp.	Endochironomus spp.			
Enochrus carinatus				Not on any status lists

Enochrus spp.	Enochrus spp.			
Epeorus spp.	Epeorus spp.			
Ephemerella spp.	Ephemerella spp.			
Ephydridae fam.	Ephydridae fam.			
Eukiefferiella claripennis				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Gomphidae fam.	Gomphidae fam.			
Gumaga griseola	A Bushtailed Caddisfly			
Gumaga spp.	Gumaga spp.			
Hetaerina americana	American Rubyspot			
Heterlimnius spp.	Heterlimnius spp.			
Holorusia hespera				Not on any status lists
Hydrobius fuscipes				Not on any status lists
Hydrophilidae fam.	Hydrophilidae fam.			
Hydropsyche alternans				Not on any status lists
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila ajax	A Caddisfly			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ischnura denticollis	Black-fronted Forktail			
Ischnura spp.	Ischnura spp.			
Isoperla spp.	Isoperla spp.			
Labrundinia maculata				Not on any status lists
Labrundinia spp.	Labrundinia spp.			
Laccobius spp.	Laccobius spp.			
Lepidostoma acarolum				Not on any status lists
Lepidostoma spp.	Lepidostoma spp.			
Libellulidae fam.	Libellulidae fam.			
Limnophyes spp.	Limnophyes spp.			
Malenka bifurcata				Not on any status lists
Malenka spp.	Malenka spp.			
Micrasema arizonica				Not on any status lists
Micrasema spp.	Micrasema spp.			
Microcylloepus spp.	Microcylloepus spp.			
Micropsectra nigripila				Not on any status lists

Micropsectra spp.	Micropsectra spp.			
Microtendipes spp.	Microtendipes spp.			
Mideopsis spp.	Mideopsis spp.			
Nanocladius spp.	Nanocladius spp.			
Nectopsyche spp.	Nectopsyche spp.			
Nemouridae fam.	Nemouridae fam.			
Ochrotrichia alexanderi	A Caddisfly			
Ochrotrichia spp.	Ochrotrichia spp.			
Ochthebius spp.	Ochthebius spp.			
Optioservus spp.	Optioservus spp.			
Orthocladius appersoni				Not on any status lists
Orthocladius spp.	Orthocladius spp.			
Paltothemis lineatipes	Red Rock Skimmer			
Parachironomus abortivus				Not on any status lists
Parachironomus spp.	Parachironomus spp.			
Paracladopelma alphaeus				Not on any status lists
Paracladopelma spp.	Paracladopelma spp.			
Parametriocnemus lundbeckii				Not on any status lists
Parametriocnemus spp.	Parametriocnemus spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Peltodytes callosus				Not on any status lists
Peltodytes spp.	Peltodytes spp.			
Pentaneura inconspicua				Not on any status lists
Pentaneura spp.	Pentaneura spp.			
Petrophila spp.	Petrophila spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			
Postelichus spp.	Postelichus spp.			
Procladius spp.	Procladius spp.			
Progomphus borealis	Gray Sanddragon			
Pseudochironomus spp.	Pseudochironomus spp.			
Pseudosmittia spp.	Pseudosmittia spp.			
Psychodidae fam.	Psychodidae fam.			
Rheotanytarsus hamatus				Not on any status lists
Rheotanytarsus spp.	Rheotanytarsus spp.			

Rhionaeschna multicolor	Blue-eyed Darner			
Sanfilippodytes spp.	Sanfilippodytes spp.			
Serratella micheneri	A Mayfly			
Simuliidae fam.	Simuliidae fam.			
Simulium anduzei				Not on any status lists
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sperchon stellata				Not on any status lists
Stictotarsus spp.	Stictotarsus spp.			
Sympetrum corruptum	Variegated Meadowhawk			
Tanytarsus angulatus				Not on any status lists
Tanytarsus spp.	Tanytarsus spp.			
Telebasis salva	Desert Firetail			
Thalassotrechus barbarae				Not on any status lists
Thienemannimyia spp.	Thienemannimyia spp.			
Tipulidae fam.	Tipulidae fam.			
Tribelos spp.	Tribelos spp.			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus ellipticus				Not on any status lists
Tropisternus salsamentus				Not on any status lists
Tropisternus spp.	Tropisternus spp.			
Tvetenia spp.	Tvetenia spp.			
Veliidae fam.	Veliidae fam.			
Wormaldia anilla	A Caddisfly			
Wormaldia spp.	Wormaldia spp.			
MOLLUSKS				
Ferrissia spp.	Ferrissia spp.			
Helisoma spp.	Helisoma spp.			
Lymnaea spp.	Lymnaea spp.			
Lymnaeidae fam.	Lymnaeidae fam.			
Menetus opercularis	Button Sprite			CS
Menetus spp.	Menetus spp.			
Physa acuta	Pewter Physa			Not on any status lists
Physa spp.	Physa spp.			
Planorbidae fam.	Planorbidae fam.			
Pyrgulopsis castaicensis	A Freshwater Snail			E
Stagnicola elodes	Marsh Pondsnail			CS
PLANTS				
Alnus rhombifolia	White Alder			

Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla filiculoides	NA			
Azolla microphylla	Mexican mosquito fern		Special	CRPR - 4.3
Baccharis salicina				Not on any status lists
Berula erecta	Wild Parsnip			
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Carex alma	Sturdy Sedge			
Castilleja minor minor	Alkali Indian-paintbrush			
Castilleja minor spiralis	Large-flower Annual Indian-paintbrush			
Cotula coronopifolia	NA			
Cyperus involucratus	NA			
Datisca glomerata	Durango Root			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Eleocharis parishii	Parish's Spikerush			
Eleocharis rostellata	Beaked Spikerush			
Eustoma exaltatum	NA			
Euthamia occidentalis	Western Fragrant Goldenrod			
Juncus acutus leopoldii	Spiny Rush		Special	CRPR - 4.2
Juncus dubius	Mariposa Rush			
Juncus macrophyllus	Longleaf Rush			
Juncus rugulosus	Wrinkled Rush			
Juncus textilis	Basket Rush			
Juncus xiphioides	Iris-leaf Rush			
Lasthenia glabrata coulteri	Coulter's Goldfields		Special	CRPR - 1B.1
Lemna valdiviana	Pale Duckweed			
Ludwigia peploides peploides	NA			Not on any status lists
Lythrum californicum	California Loosestrife			
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus guttatus	Common Large Monkeyflower			
Mimulus parishii	Parish's Monkeyflower			
Mimulus pilosus				Not on any status lists

Najas guadalupensis guadalupensis	Southern Naiad			
Orcuttia californica	California Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Paspalum distichum	Joint Paspalum			
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phacelia distans	NA			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Pluchea odorata odorata	Scented Conyza			
Pluchea sericea	Arrow-weed			
Potamogeton foliosus foliosus	Leafy Pondweed			
Rumex conglomeratus	NA			
Rumex salicifolius salicifolius	Willow Dock			
Salix exigua exigua	Narrowleaf Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus americanus	Three-square Bulrush			
Schoenoplectus californicus	California Bulrush			
Scirpus microcarpus	Small-fruit Bulrush			
Stachys albens	White-stem Hedge-nettle			
Stuckenia pectinata				Not on any status lists
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	NA			
Zannichellia palustris	Horned Pondweed			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

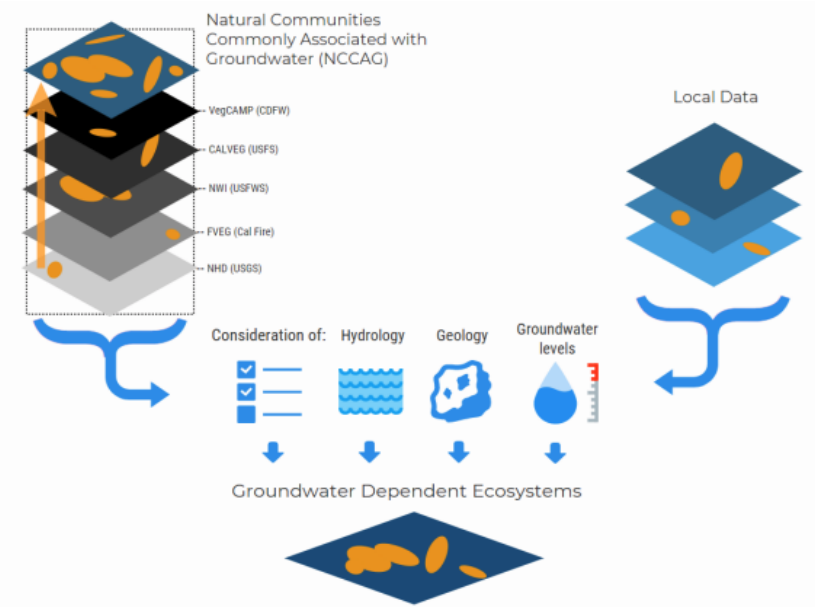


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

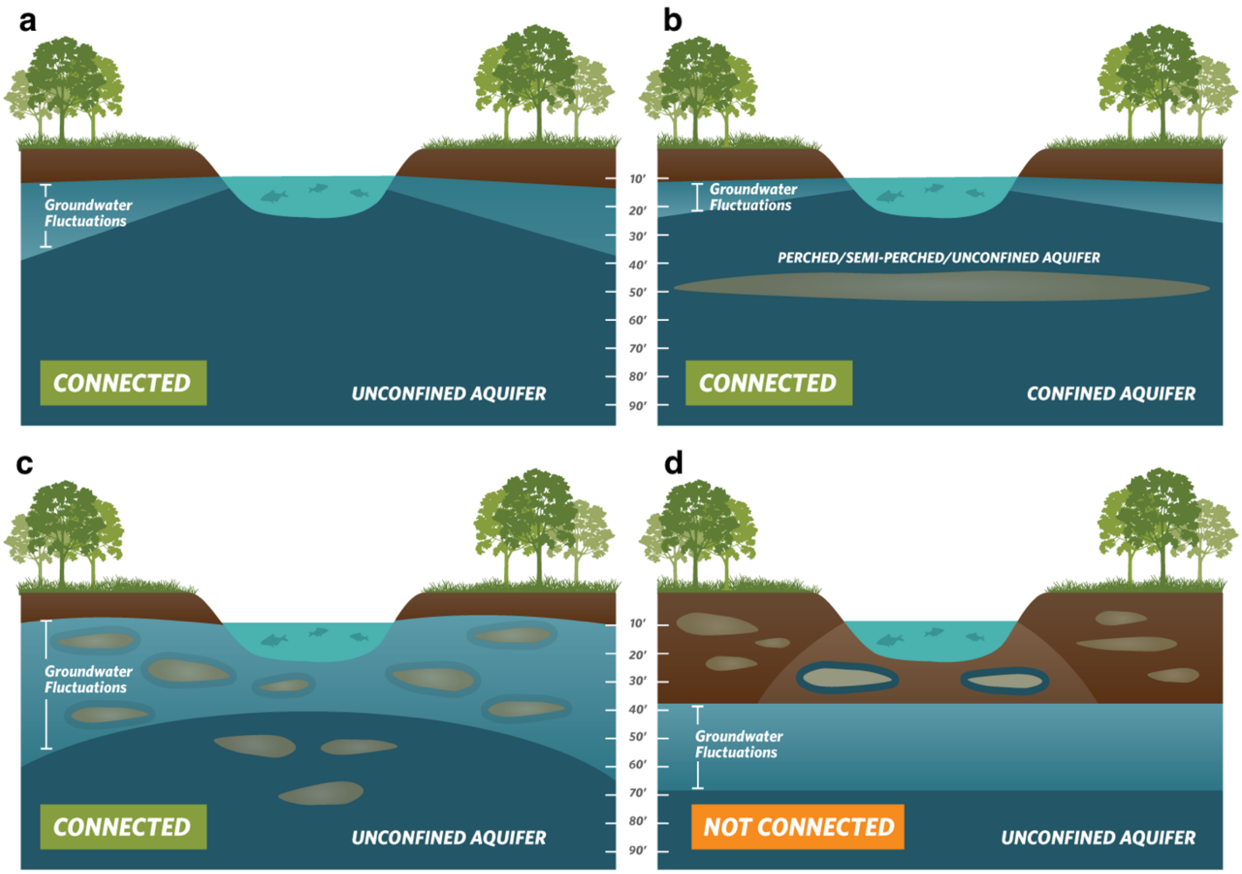

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

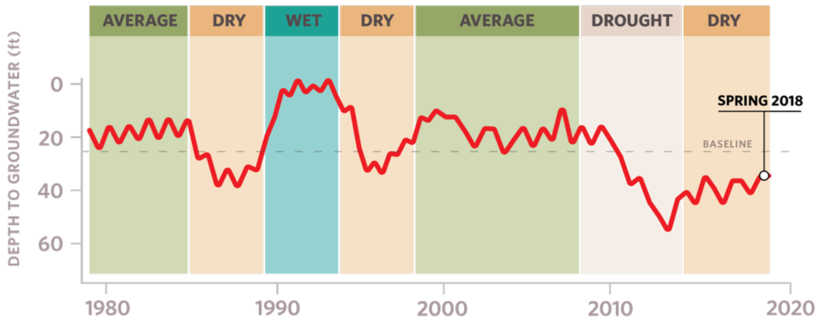

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

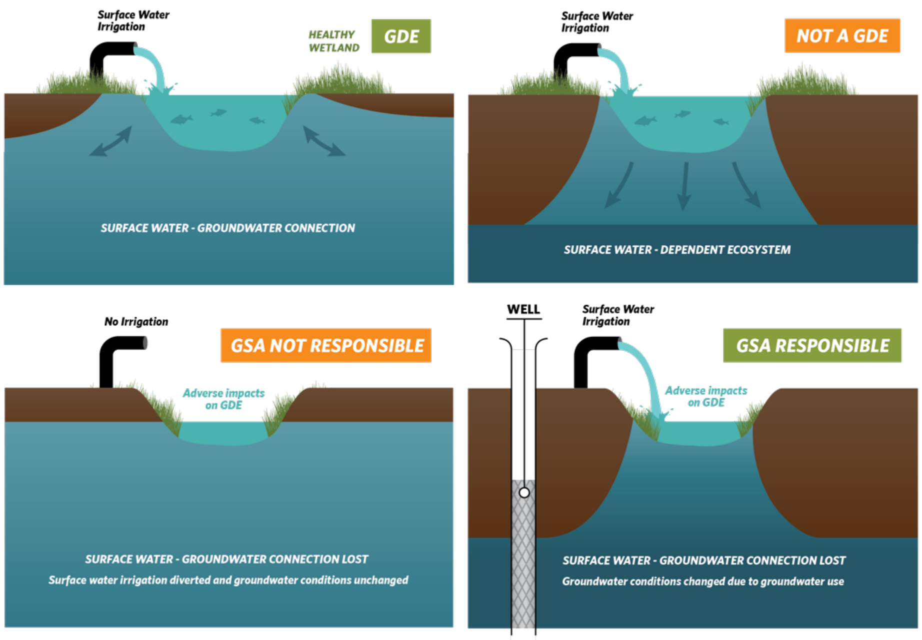

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

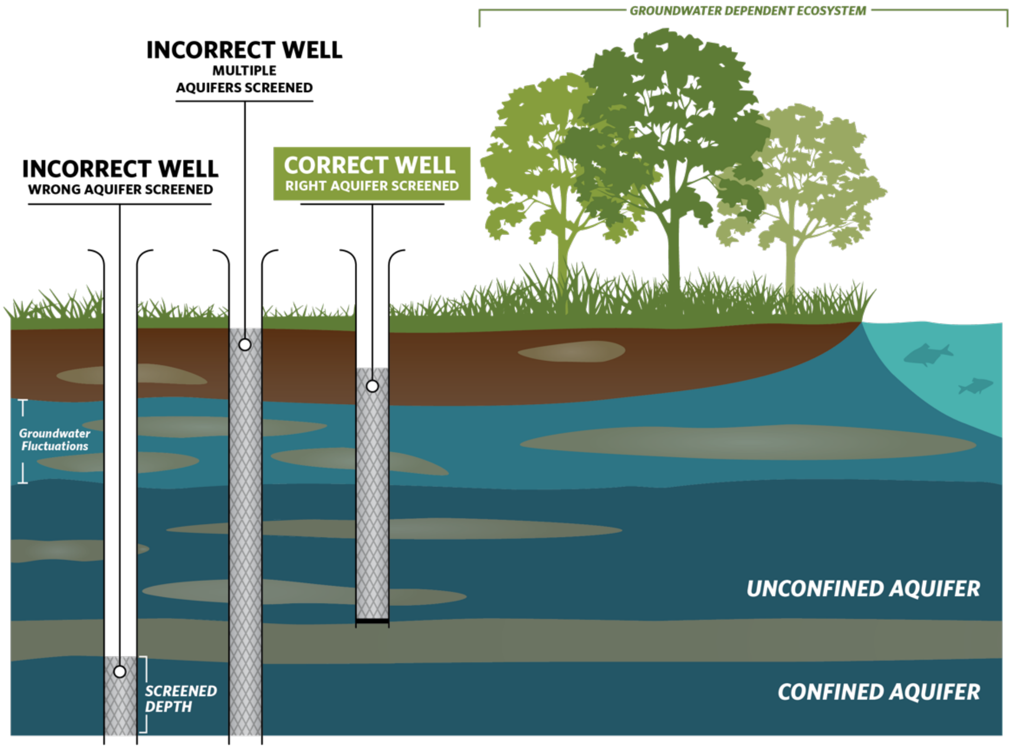

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

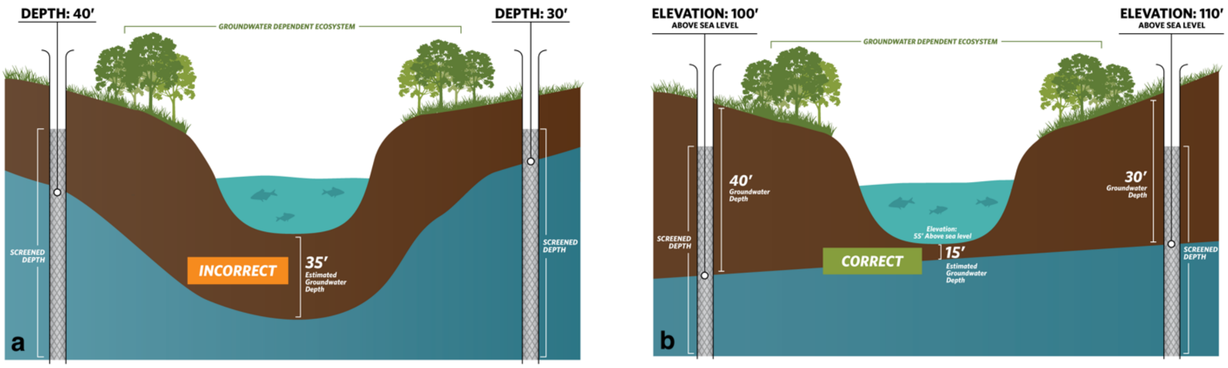

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

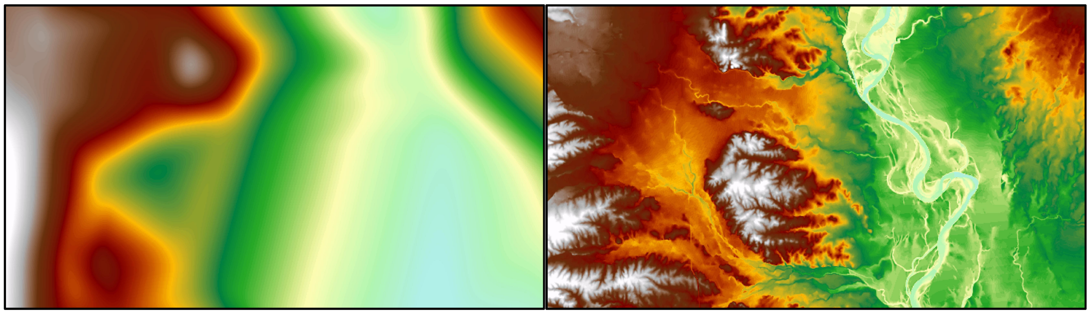

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

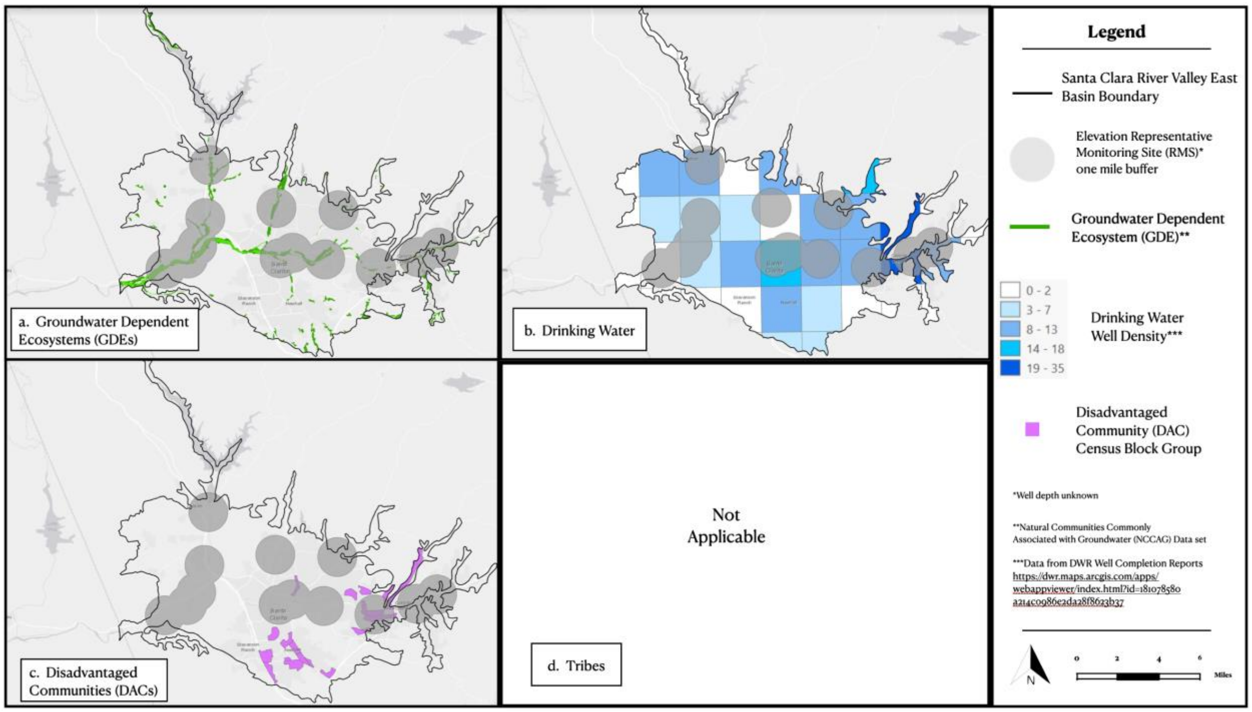

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

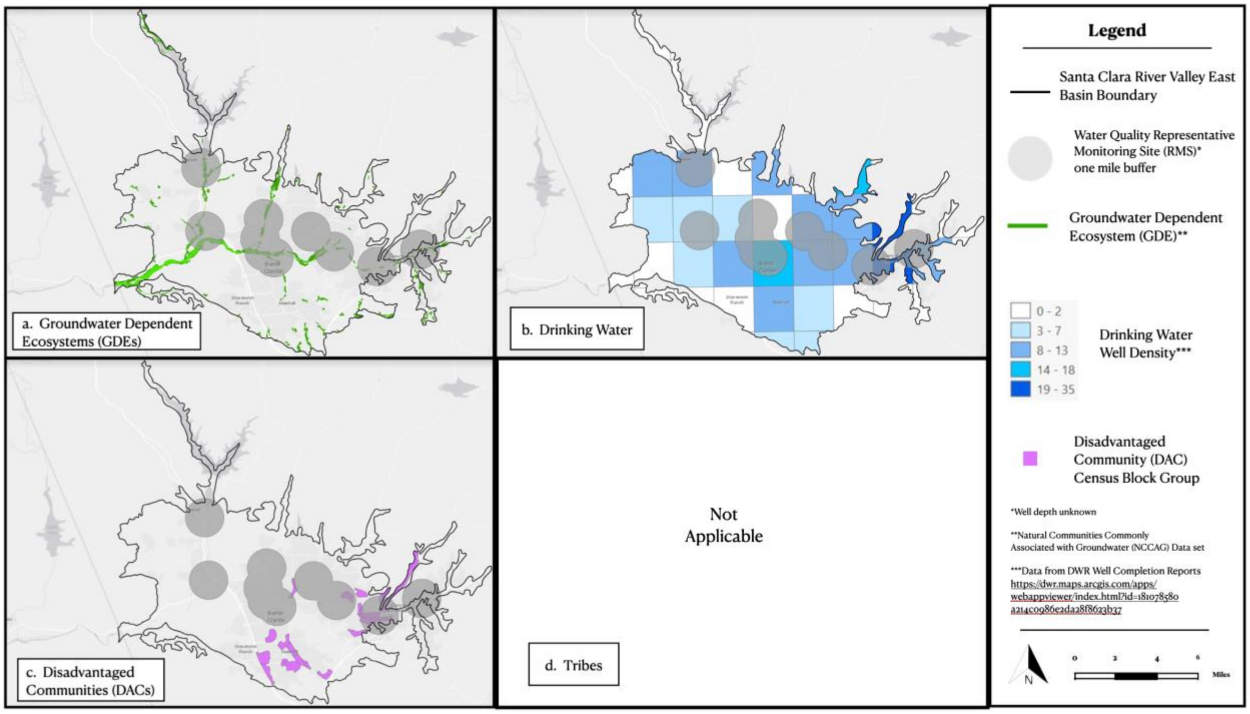

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

September 20, 2021

Santa Margarita Groundwater Agency

Submitted via web: https://www.smgwa.org/publicfeedbackform

Re: Public Comment Letter for the Santa Margarita Groundwater Basin Draft GSP

Dear Sierra Ryan,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Santa Margarita Groundwater Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Santa Margarita Groundwater Basin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Santa Margarita Groundwater Basin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. We note the following deficiencies with the identification of these key beneficial users.

- The GSP states that there are two DAC census block groups, both of which are partially located within the basin (Figure 2-9). Within the basin, the DACs include part of the Census Designated Places of Boulder Creek, Brookdale, and Ben Lomond. The GSP, however, does not describe the size of the population in each DAC.

- The GSP shows the estimated location of private residential groundwater use (Figure 2-31), but provides no information on depth of these domestic wells. The GSP provides a well density map showing the number of all water supply wells, including municipal, small water systems, private domestic, and industrial (Figure 2-32), but all water supply wells are grouped together in this single figure.

- Figure 2-9 maps locations of small water systems and private domestic wells. However, specifics are not given about how much each community relies on a particular water supply (e.g., what percentage is supplied by groundwater).

- The GSP states: “The [Amah Mutsun] Tribal Band is petitioning the federal government for tribal recognition and has formed the Amah Mutsun Land Trust to access, protect, and steward lands important to the tribe.” The location of these lands, however, is not provided.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, to support the development of water budgets using the best available information, and to support the development of sustainable management criteria and projects and management actions (PMAs) that are protective of these users.

RECOMMENDATIONS

- Include a map showing domestic well locations and average well depth across the basin.
- Include a well density map for domestic wells only, not all water supply wells.
- Provide the population of each identified DAC block group and include details on the population dependent on groundwater for their domestic water use.
- Describe tribal interests in the basin, including lands with historical importance to the tribe.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **incomplete**, due to the lack of a complete description of data gaps for ISWs.

We commend the GSA for the thorough, comprehensive evaluation of ISWs in the basin presented in the GSP. Figure 2-72 presents the spatial and temporal distribution of interconnected surface water. To analyze ISWs in the basin, the GSP uses accretion studies and comparisons between stream bed elevations and 30 years of proximal monitoring wells data (Figures 3-8 and 3-9). Findings from these studies and observations are combined with model-simulated groundwater elevations to produce the ISW map presented in Figure 2-72.

The following recommendations would strengthen the clarity and completeness of the ISW evaluation.

RECOMMENDATIONS

- While the GSP identifies data gaps and their locations in GSP Section 2.2.4.11 (Hydrogeologic Conceptual Model Data Gaps), please also describe the data gaps in the ISW section.
- On the ISW map (Figure 2-72), clearly label the areas with data gaps. We recommend that the GSP considers any segments with data gaps as *potential* ISWs and clearly marks them as such on the ISW map.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of comprehensive, systematic analysis of the basin's GDEs.

The GSP states (p. 2-98) that the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) was used as a starting point, and "[i]n addition, several known springs, seeps, or other groundwater-dependent wetlands were identified as likely GDEs." We commend the GSA for starting with the NC dataset and using additional sources to identify GDEs in the basin.

Further description in the GSP, however, of the GDE analysis process is very sparse. The GSP states (p. 2-98): "The GDE analysis in this GSP includes assessment of the extent of GDE indicator vegetation, groundwater elevations in shallow aquifers, and impacts of seasonal surface water and groundwater interaction or accretion. Where groundwater level data are unavailable, the groundwater model is used to identify where surface water and groundwater are likely connected." This statement is the only description of how the GDEs were identified. The GSP does not discuss how the NC dataset was verified with the use of groundwater data from the shallow aquifer or model output (e.g., which locations were verified with each method). Without an analysis of groundwater data to verify the NC dataset polygons, it will be difficult or impossible to adequately monitor and manage the basin's GDEs throughout GSP implementation.

RECOMMENDATIONS

- Develop and describe a systematic approach for analyzing the basin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained, removed, or added to/from the NC dataset (include the removal reason if polygons are not considered potential GDEs, or include the data source if polygons are added). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included into the water budget. The integration of native vegetation into the water budget is **insufficient**. The water budget did not explicitly include the current, historical, and projected demands of native vegetation. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation. If native vegetation is included as one of the land use types in the numerical model, specifically state this in the GSP and provide a separate line item in water budget tables.
- State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the Stakeholder Communication and Engagement Plan included in the GSP (Appendix 2A).

We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms. They include maintenance of the SMGWA website; continued social media presence through Facebook and Instagram; email newsletter; youth engagement efforts; promoting and conducting community meetings, workshops and events; coordination with member agencies to share information; and developing print materials.
- Private domestic pumpers, small water systems, and the Amah Mutsun Tribal Band are listed as private users. Disadvantaged communities, environmental justice groups, and human service nonprofits are listed under the human right to water category (p. 8 in the Stakeholder Communication and Engagement Plan). However very little information is

[1] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]
[2] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]
[3] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

provided other than stating that their participation is invited in the GSP development process.

- The Stakeholder Outreach Plan does not include enough detail describing plans for continual opportunities for engagement through the *implementation* phase of the GSP for stakeholders.

RECOMMENDATIONS

- Include a more detailed and robust Stakeholder Communication and Engagement Plan that describes active and targeted outreach to engage DACs, domestic well owners, environmental stakeholders, and tribal stakeholders during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Describe efforts to consult and engage with tribes within the basin. Refer to the DWR guidance entitled *Engagement with Tribal Governments* for specifics on how to consult with tribes.[4]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[5] and establishing minimum thresholds.[6,7]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, while the GSP does describe or analyze direct or indirect impacts on domestic drinking water wells when defining undesirable results (p. 3-54), the GSP does not sufficiently describe how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results in the basin.

For degraded water quality, the GSP sets SMC for all identified Contaminants of Concern (COCs) in the basin. Water quality minimum thresholds are based on the Maximum Contaminant levels (MCLs). The GSP does not, however, specifically analyze direct and indirect impacts on DACs or

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[4] DWR Guidance Document for Engagement with Tribal Governments https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[5] “The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.” [23 CCR §354.26(b)(3)]

[6] “The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.” [23 CCR §354.28(b)(4)]

[7] “The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference.” [23 CCR §354.28(b)(5)]

tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs or tribes. The GSP may group DACS under rural residents. The GSP states: "When developing the GSP, the SMGWA considered impacts on all beneficial uses and users, including domestic well owners, Disadvantaged Communities (DACs), and priority species." We recommend that undesirable results specifically describe direct and indirect impacts to DACs and tribes.

RECOMMENDATIONS
Chronic Lowering of Groundwater Levels ● Describe direct and indirect impacts on DACs and tribes when defining undesirable results for chronic lowering of groundwater levels, in addition to describing impacts to drinking water users. ● Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs, drinking water users, and tribes within the basin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold. **Degraded Water Quality** ● Describe direct and indirect impacts on DACs and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[8] ● Evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs and tribes.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP sets minimum thresholds for chronic lowering of groundwater levels to the average of the five lowest historical minimum elevations, and states that "[b]ecause historical levels have not appeared to cause significant and unreasonable conditions in the past, these levels should continue to support similar beneficial use in the future." As a proxy for the depletion of interconnected surface water SMC, two monitoring wells from the existing monitoring network adjacent to creeks and screened in the aquifer connected to the creek will be used as RMPs for the depletion of interconnected surface water. Consistent with the approach used for chronic lowering of groundwater level minimum threshold, historical data from the two existing surface water depletion RMPs are used to develop surface water depletion minimum thresholds.

The GSP makes the following statement under effects of minimum thresholds on beneficial users for ecological land uses and users (p. 3-61): "Maintaining groundwater elevations at or above historical levels will maintain the very connected nature of groundwater and surface water in the Basin. This will protect GDE habitat used by priority species, and generally benefit ecological land uses and users." However, the true impacts to ecosystems under this scenario are not fully

[8] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

discussed in the GSP. In fact, the GSP states (p. 2-47): "Impacts to GDEs within the Basin have yet to be identified. The groundwater model shows a Basin-wide reduction in streamflow from pumping, but without GDE monitoring data, a quantifiable correlation has yet to be established."

If minimum thresholds are set to historic low groundwater levels and the basin is allowed to operate at or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse.

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[9] in the basin. Defining undesirable results is the crucial first step before the minimum thresholds[10] can be determined.
- For the interconnected surface water SMC, the undesirable results should include a description of potential impacts on instream habitats within ISWs when defining minimum thresholds in the basin[11]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,12].

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[13] require integration of climate

[9] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[10] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[11] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]
[12] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf
[13] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply,

change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using a transient climate projection based on an ensemble of four commonly used global climate models. However, the GSP did not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

We acknowledge and commend the inclusion of climate change into key inputs (e.g., precipitation, evaporation, and surface water flow) of the projected water budget. Additionally, the sustainable yield is calculated based on the projected pumping with climate change incorporated. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Integrate extreme wet and dry scenarios into the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of clarity around the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, and GDEs.

The GSP states that areas with data gaps in the shallow aquifer include communities where there are a large number of private domestic wells pumping from either the Santa Margarita Sandstone or Monterey Formation, and areas where shallow groundwater is connected to surface water and groundwater pumping may be causing depletion of surface water. Figure 3-6 shows the locations of eight new monitoring wells to be installed in 2022. However, these wells are not shown on Figure 3-7 (Representative Monitoring Points for Groundwater Levels) or on Figure 3-13 (Representative Monitoring Points for Groundwater Quality). It is therefore difficult to determine if existing or proposed monitoring sites adequately represent shallow groundwater conditions in areas of the basin with DACs, domestic wells, and GDEs.

land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

We commend the GSA for including GDE-related biological monitoring in the monitoring network. The GSP states that this will include use of the Nature Conservancy's GDE Pulse tool, and field assessments that will take place twice a year to include photo monitoring and site observations of GDEs.

RECOMMENDATIONS

- Provide a complete set of maps that overlay monitoring well locations (both existing RMPs and new RMPs) with the locations of DACs, domestic wells, and GDEs to clearly identify potentially impacted areas. Ensure that existing and proposed RMPs adequately cover DAC, domestic well, and GDE portions of the basin.
- Evaluate how the gathered data will be used to identify and map GDEs and ISWs, and to identify DACs and shallow domestic well users that are vulnerable to undesirable results.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to failing to completely identify benefits or impacts of identified projects and management actions to key beneficial users.

The GSP incorporates project and management actions into projected water budgets and sustainable yield. Additionally, the GSP acknowledges that SMGWA-approved projects and management activities might impact beneficial users of groundwater and lists the ways in which some beneficial users could be impacted, depending on the approved project. However, there is very little discussion of the manner in which DACs and tribes may be benefitted or impacted from identified projects and management actions. Therefore, potential project and management actions may not protect these beneficial users.

Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for all beneficial users. GDEs, DACs, and tribes were not sufficiently identified in the GSP. Therefore, potential project and management actions may not protect these beneficial users of groundwater. The following recommendations can improve the projects and management actions section of the GSP.

RECOMMENDATIONS

- Recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to

integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[14].

- For DACs and domestic well owners, include discussion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts. Impacts to supply wells are discussed, but not to DACs and domestic well owners.

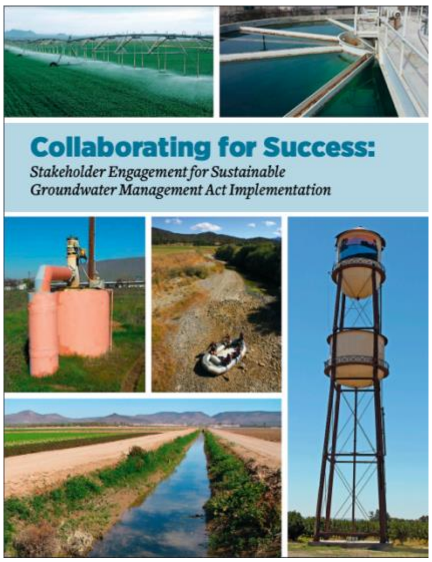
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[14] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

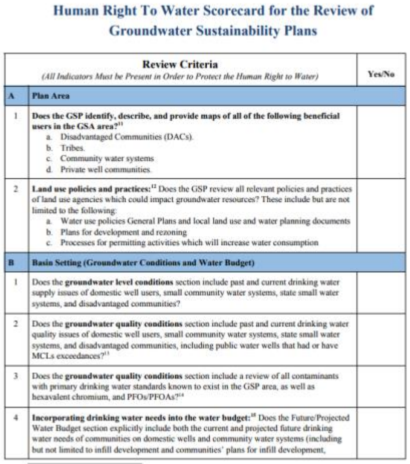
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

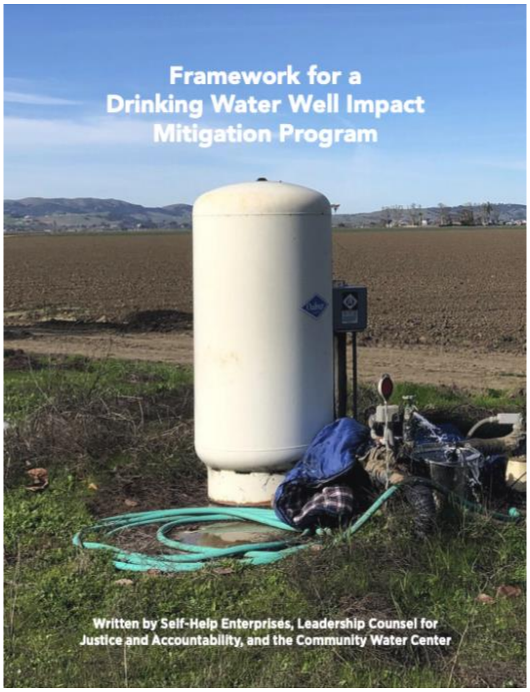


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

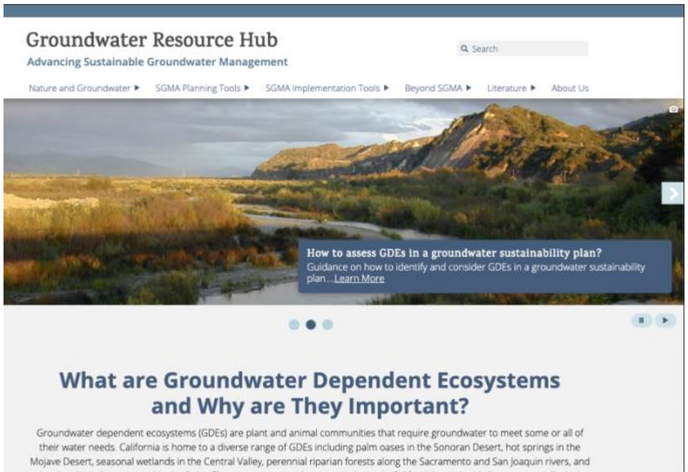
The [Human Right to Water Scorecard](#) was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



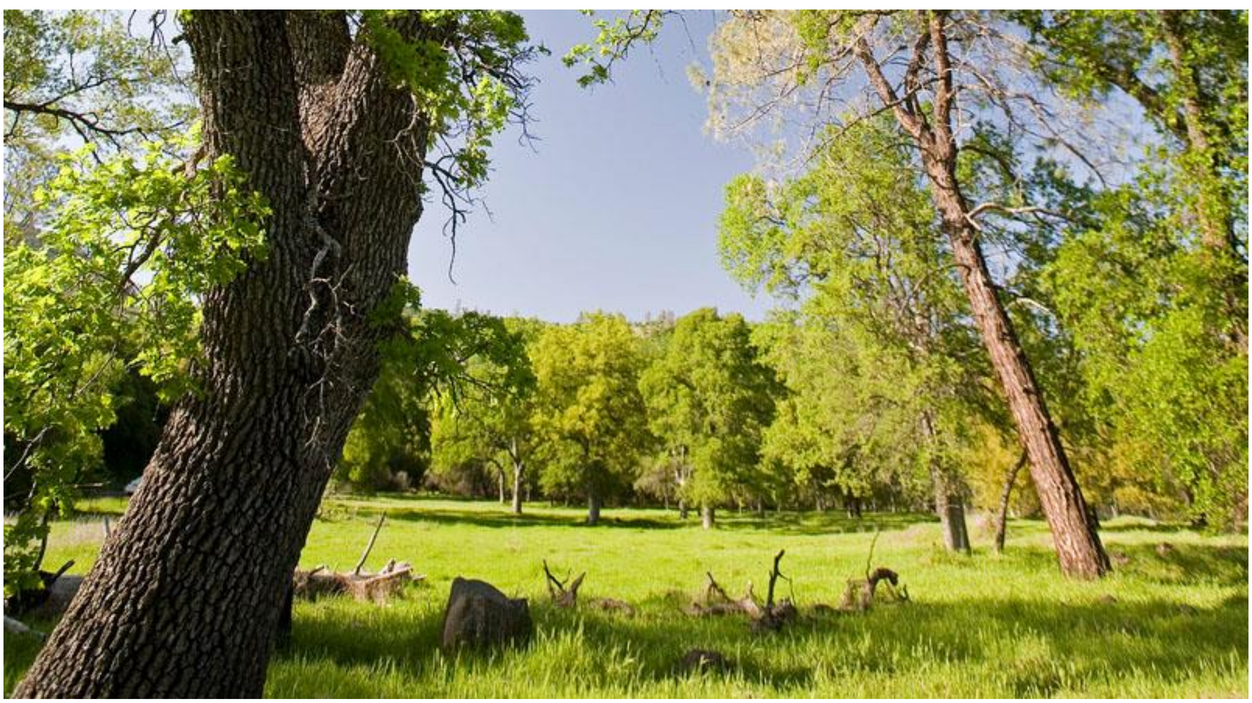
The [Drinking Water Well Impact Mitigation Framework](#) was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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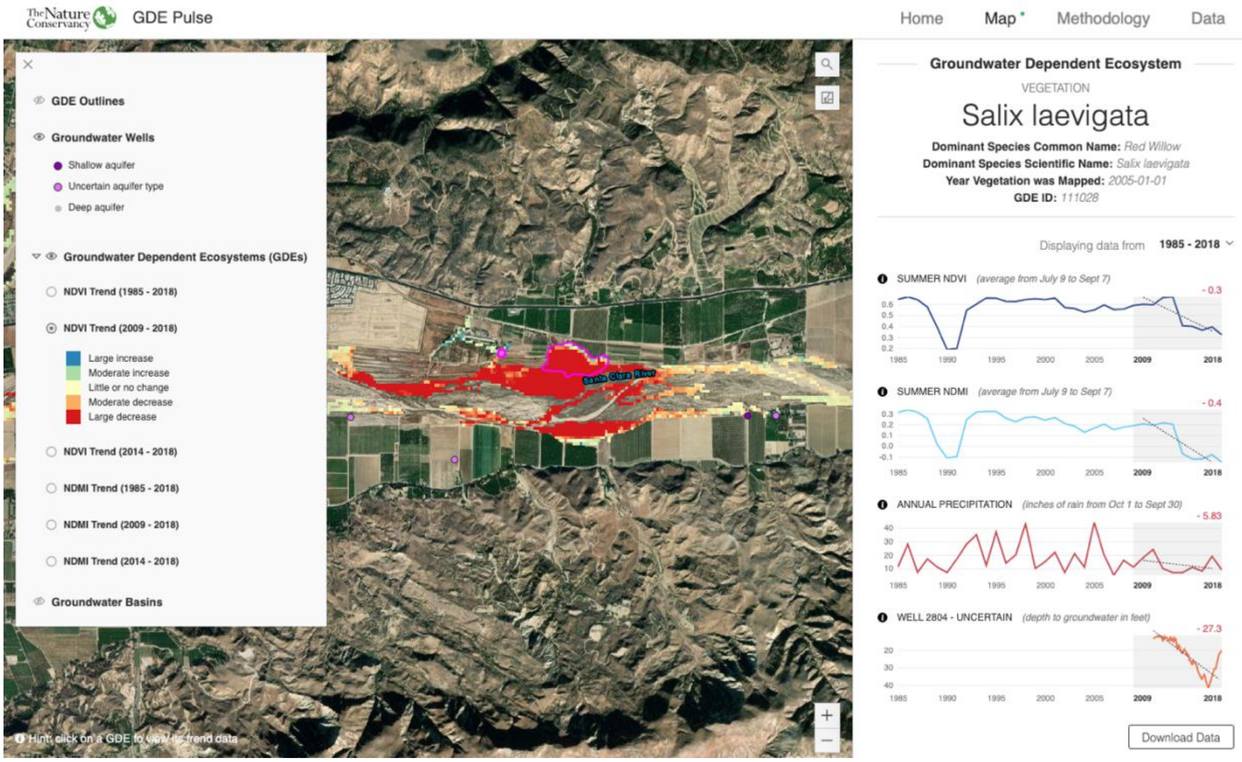
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

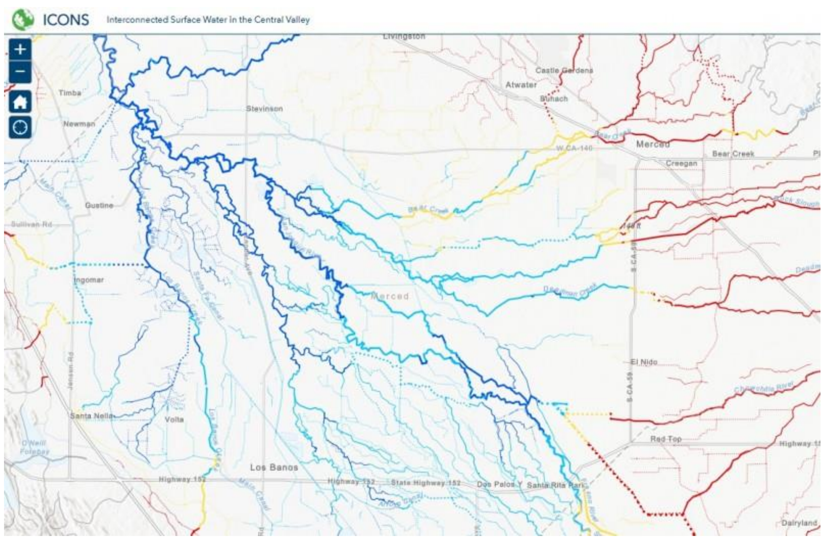
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Santa Margarita Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result “depletion of interconnected surface waters”, Attachment C provides a list of freshwater species located in the Santa Margarita Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife’s BIOS[2] as well as on The Nature Conservancy’s science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Butorides virescens	Green Heron			
Calidris minutilla	Least Sandpiper			
Chen rossii	Ross's Goose			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cypseloides niger	Black Swift	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Phalacrocorax auritus	Double-crested Cormorant			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa solitaria	Solitary Sandpiper			
CRUSTACEANS				
Gammarus spp.	Gammarus spp.			
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus mykiss - CCC winter	Central California coast winter steelhead	Threatened	Special	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC

Anaxyrus boreas boreas	Boreal Toad			
Dicamptodon ensatus	California Giant Salamander			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Pseudacris regilla	Northern Pacific Chorus Frog			
Pseudacris sierra	Sierran Treefrog			
Thamnophis atratus atratus	Santa Cruz Gartersnake			Not on any status lists
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis elegans terrestris	Coast Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Aeshnidae fam.	Aeshnidae fam.			
Agabus spp.	Agabus spp.			
Agapetus spp.	Agapetus spp.			
Amiocentrus aspilus	A Caddisfly			
Antocha monticola				Not on any status lists
Antocha spp.	Antocha spp.			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brachycentridae fam.	Brachycentridae fam.			
Brillia spp.	Brillia spp.			
Calineuria californica	Western Stone			
Callibaetis spp.	Callibaetis spp.			
Centroptilum spp.	Centroptilum spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Chloroperlidae fam.	Chloroperlidae fam.			
Cinygmula spp.	Cinygmula spp.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Cleptelmis addenda				Not on any status lists

Conchapelopia spp.	Conchapelopia spp.			
Cordulegaster dorsalis	Pacific Spiketail			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Drunella coloradensis	A Mayfly			
Drunella flavilinea	A Mayfly			
Drunella spp.	Drunella spp.			
Enallagma basidens	Double-striped Bluet			
Enallagma cyathigerum				Not on any status lists
Enallagma praevarum	Arroyo Bluet			
Epeorus spp.	Epeorus spp.			
Ephemerella maculata	A Mayfly			
Ephemerella spp.	Ephemerella spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Eubrianax edwardsii				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Glossosoma spp.	Glossosoma spp.			
Glossosomatidae fam.	Glossosomatidae fam.			
Gyrinus spp.	Gyrinus spp.			
Heptageniidae fam.	Heptageniidae fam.			
Hesperoperla spp.	Hesperoperla spp.			
Heterotrissocladius spp.	Heterotrissocladius spp.			
Holorusia hespera				Not on any status lists
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Ischnura cervula	Pacific Forktail			
Ischnura perparva	Western Forktail			
Isoperla spp.	Isoperla spp.			
Kogotus nonus	Smooth Springfly			
Lepidostoma spp.	Lepidostoma spp.			
Leucotrichia pictipes	A Micro Caddisfly			
Libellula pulchella	Twelve-spotted Skimmer			
Libellula saturata	Flame Skimmer			
Limnephilus frijole	A Caddisfly			

Malenka spp.	Malenka spp.			
Maruina lanceolata				Not on any status lists
Matriella teresa	A Mayfly			
Micropsectra spp.	Micropsectra spp.			
Microtendipes spp.	Microtendipes spp.			
Mideopsis spp.	Mideopsis spp.			
Nanocladius spp.	Nanocladius spp.			
Narpus spp.	Narpus spp.			
Nemouridae fam.	Nemouridae fam.			
Neophylax rickeri	A Caddisfly			
Neophylax spp.	Neophylax spp.			
Neotrichia spp.	Neotrichia spp.			
Octogomphus specularis	Grappletail			
Optioservus quadrimaculatus				Not on any status lists
Optioservus spp.	Optioservus spp.			
Oreodytes spp.	Oreodytes spp.			
Pachydiplax longipennis	Blue Dasher			
Paltothemis lineatipes	Red Rock Skimmer			
Pantala hymenaea	Spot-winged Glider			
Paracladopelma spp.	Paracladopelma spp.			
Parakiefferiella spp.	Parakiefferiella spp.			
Paraleptophlebia spp.	Paraleptophlebia spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Parapsyche almota	A Caddisfly			
Parapsyche spp.	Parapsyche spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Paratendipes spp.	Paratendipes spp.			
Perlidae fam.	Perlidae fam.			
Perlodidae fam.	Perlodidae fam.			
Petrophila spp.	Petrophila spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Plathemis lydia	Common Whitetail			
Plumiperla spp.	Plumiperla spp.			
Polycentropus spp.	Polycentropus spp.			
Polypedilum aviceps				Not on any status lists
Polypedilum scalaenum				Not on any status lists
Polypedilum spp.	Polypedilum spp.			
Polypedilum tritum				Not on any status lists

Protanyderus spp.	Protanyderus spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Rhyacophila spp.	Rhyacophila spp.			
Robackia spp.	Robackia spp.			
Serratella micheneri	A Mayfly			
Serratella spp.	Serratella spp.			
Sialis spp.	Sialis spp.			
Sigara mckinstryi	A Water Boatman			Not on any status lists
Sigara spp.	Sigara spp.			
Simuliidae fam.	Simuliidae fam.			
Simulium spp.	Simulium spp.			
Siphlonurus spp.	Siphlonurus spp.			
Skwala spp.	Skwala spp.			
Sperchon spp.	Sperchon spp.			
Sublettea spp.	Sublettea spp.			
Suwallia spp.	Suwallia spp.			
Sweltsa spp.	Sweltsa spp.			
Sympetrum corruptum	Variegated Meadowhawk			
Sympetrum illotum	Cardinal Meadowhawk			
Tanypus spp.	Tanypus spp.			
Tanytarsus spp.	Tanytarsus spp.			
Telebasis salva	Desert Firetail			
Thienemannimyia spp.	Thienemannimyia spp.			
Timpanoga hecuba	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
Tvetenia spp.	Tvetenia spp.			
Wormaldia spp.	Wormaldia spp.			
Zaitzevia spp.	Zaitzevia spp.			
Zoniagrion exclamationis	Exclamation Damsel			
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Ferrissia spp.	Ferrissia spp.			
Gyraulus spp.	Gyraulus spp.			
Hydrobiidae fam.	Hydrobiidae fam.			
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Pyrgulopsis spp.	Pyrgulopsis spp.			
Sphaeriidae fam.	Sphaeriidae fam.			
PLANTS				

Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Beckmannia syzigachne	American Sloughgrass			
Callitriche marginata	Winged Water-starwort			
Campanula californica	Swamp Harebell		Special	CRPR - 1B.2
Carex densa	Dense Sedge			
Cirsium douglasii douglasii	Douglas' Thistle			
Cyperus erythrorhizos	Red-root Flatsedge			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis rostellata	Beaked Spikerush			
Galium trifidum	Small Bedstraw			
Hydrocotyle ranunculoides	Floating Marsh-pennywort			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Juncus falcatus falcatus	Sickle-leaf Rush			
Juncus phaeocephalus phaeocephalus	Brown-head Rush			
Lilium pardalinum pardalinum	Leopard Lily			
Ludwigia palustris	Marsh Seedbox			
Lupinus polyphyllus polyphyllus	Bigleaf Lupine			
Lysichiton americanus	Yellow Skunk-cabbage			
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus guttatus	Common Large Monkeyflower			
Panicum dichotomiflorum	NA			
Phacelia distans	NA			
Plagiobothrys chorisianus	NA		Special	CRPR - 1B.2
Platanus racemosa	California Sycamore			
Psilocarphus tenellus	NA			
Rhododendron columbianum				Not on any status lists
Rhododendron occidentale occidentale	Western Azalea			
Salix lasiandra lasiandra				Not on any status lists
Salix sitchensis	Sitka Willow			

Sequoia sempervirens				
Solidago elongata				Not on any status lists
Spiranthes romanzoffiana	Hooded Ladies'-tresses			
Triglochin scilloides	NA			Not on any status lists
Veronica americana	American Speedwell			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

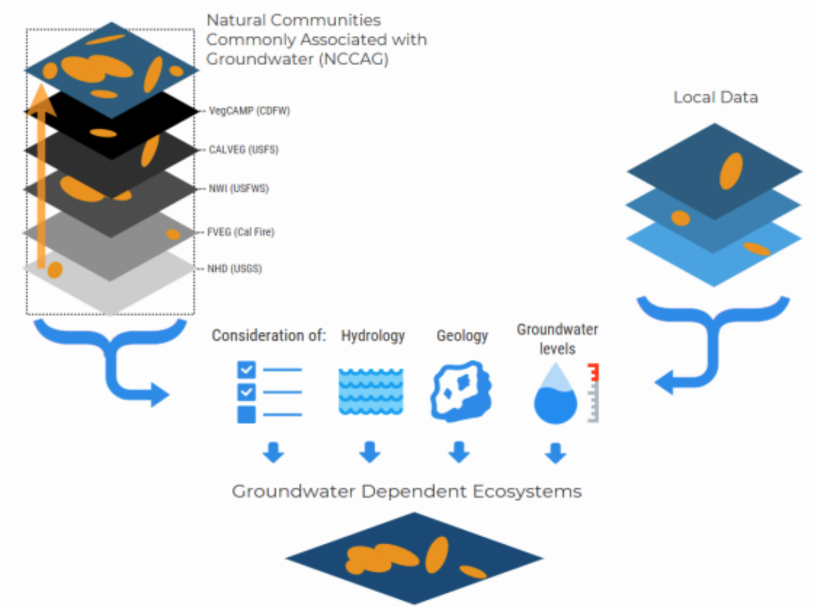


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

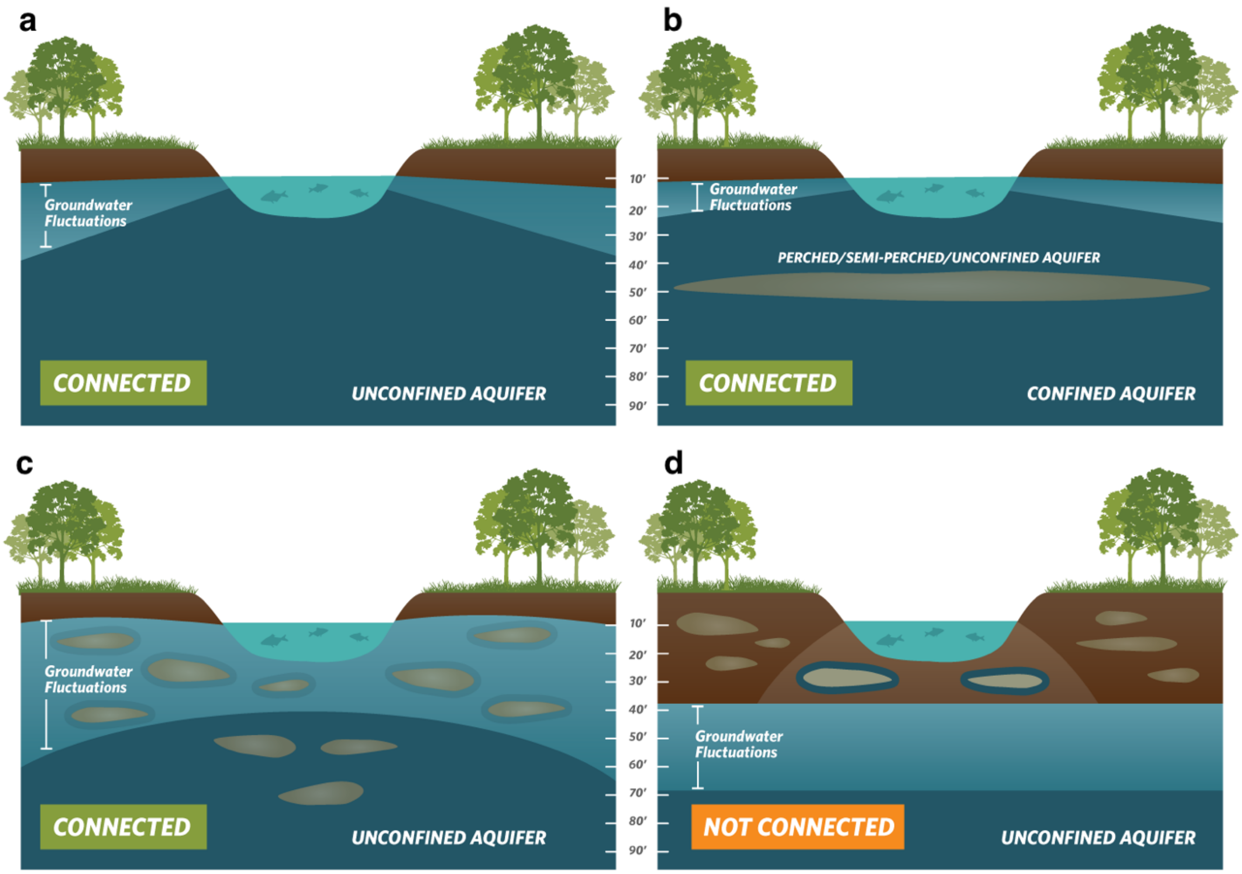

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

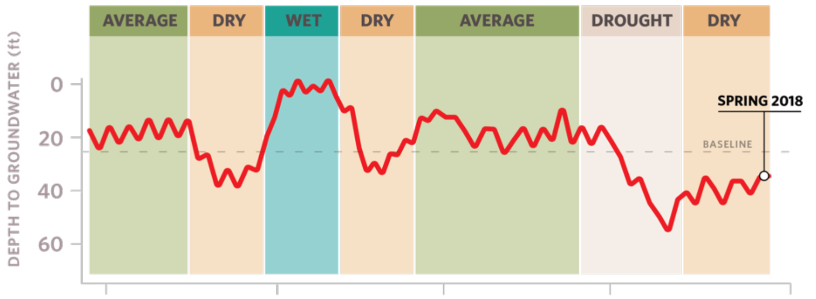

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

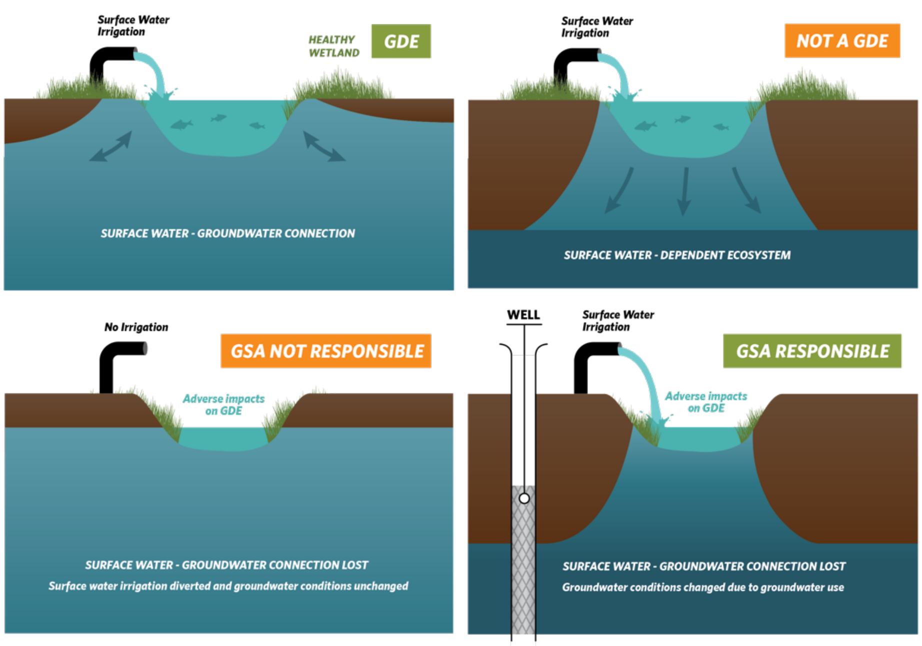

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

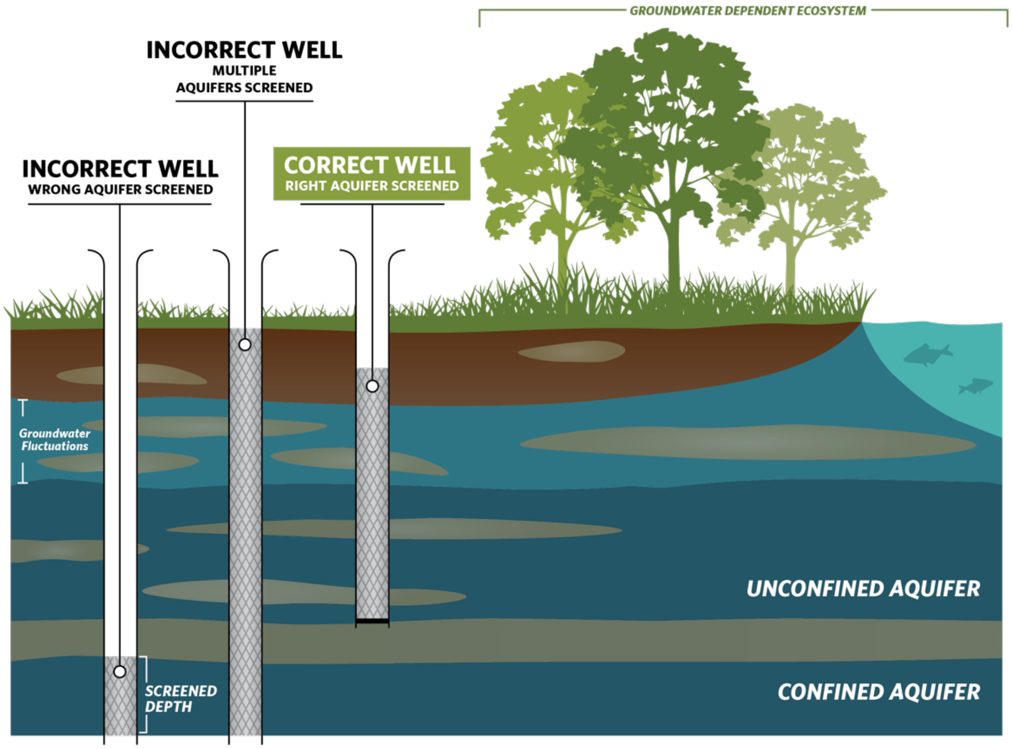

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

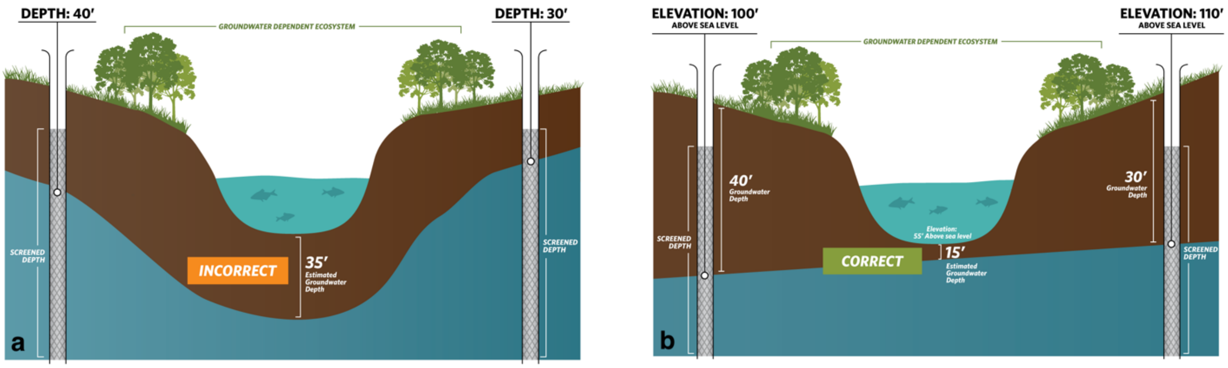

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

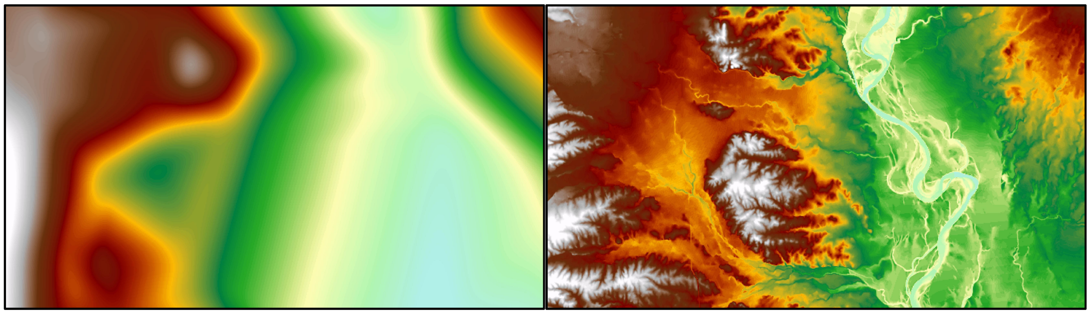

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

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[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

September 28, 2021

The Santa Monica Basin Groundwater Sustainability Agency

Submitted via email: lisette.gold@santamonica.gov

Re: Public Comment Letter for Santa Monica Groundwater Subbasin Draft GSP

Dear Lisette Gold,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Santa Monica Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Santa Monica Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the subbasin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Santa Monica Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. While the GSP provides basic information on DACs, including identification by name, location, and population densities on a map (Figure 2-8) as determined by the California Department of Water Resources DAC Mapping Tool, the plan fails to identify the population dependent on groundwater as their source of drinking water in these communities. The plan also fails to provide a density map of domestic wells in the subbasin, or other information about location and depth of domestic wells. These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS
• Include a map and inventory of all domestic wells by location and by depth, and a domestic well density map. • Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). The GSP states that “DAC block groups are located in portions of the City of Santa Monica, the City of Los Angeles including the UCLA campus and Venice Beach, and the unincorporated area around the West Los Angeles Veterans Affair campus.” However, the GSP does not currently provide clear information on how and to what extent DAC members rely on groundwater.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**. ISWs were inadequately dismissed based on the incorrect assertion that the shallow aquifers are not principal aquifers, despite the recognition in the Water Budget section of the GSP that there is a likely connection between shallow groundwater and surface water. The GSP states (p. 2-95): “Groundwater outflows occur to ephemeral streams that enter the Subbasin from the Santa Monica Mountains and to Ballona Creek (Figure 2-3). During dry years the modeled outflows are typically less than a few hundred AFY (Table 2-25). However, in wet years such as 1998 and

2005, these flows can exceed 4,000AF (Table 2-25). The combined outflows to ephemeral streams and to Ballona Creek totaled 7,300 AFY and 6,400 AFY in 1998 and 2005, respectively." The GSP further states (p. 2-78): "Infiltration of surface water into the Bellflower aquitard downstream of Centinela Avenue, contributes to the palustrine Ballona Creek Wetlands, located approximately half a mile downstream. These wetlands constitute the primary area of groundwater-surface water interaction in the Subbasin."

SGMA defines principal aquifers as "aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems" [23 CCR § 351 (aa)]. The shallow groundwater system, consisting of the Bellflower aquitard and the Ballona aquifer, are indeed principal aquifers that must be protected under SGMA. Because the shallow aquifers are not recognized as principal aquifers, potential ISWs are not being identified, described, nor managed in the GSP. Until a disconnection can be proven, include all potential ISWs in the GSP. This is necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water.

RECOMMENDATIONS

- Include a map of stream reaches in the subbasin. Label the reaches as interconnected, disconnected, or potential ISWs.
- Include the shallow groundwater system as a principal aquifer in this GSP to ensure adequate monitoring and management of this critical groundwater resource for current and future beneficial users.
- Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.
- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend that data is used from the pre-SGMA baseline period of 2005-2015.
- Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of description of supporting data for the analysis of the subbasin's GDEs.

The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). The GSP retains nearly all of the NC dataset polygons in the subbasin as potential GDEs (with the exception of a small paved pond area at the

Kenneth Hahn State Recreation Area Unit). However, the GSP does not fully describe how groundwater data from the underlying shallow aquifer was used to verify the NC dataset. The GSP text refers to Appendix E (Groundwater Elevation Hydrographs), but more information should be provided in the text regarding specific wells and temporal data used to verify the NC dataset polygons. Without an adequate analysis of groundwater data to verify the NC dataset polygons, it will be difficult or impossible to adequately monitor and manage the GDEs throughout GSP implementation.

We commend the GSA for including an inventory of fauna and flora species in the subbasin's GDEs (Tabe 2-19) and a list of special status species present in the Ballona Wetlands Ecological Reserve (Table 2-20).

RECOMMENDATIONS
● Overlay GDE locations with depth-to-groundwater contour maps. Show well locations on these maps. For the contour maps, note the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. ● Use and describe depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included into the water budget. The integration of these ecosystems into the water budget is **insufficient**. The water budget did not include the current, historical, and projected demands of native vegetation and managed wetlands. The omission of explicit water demands for native vegetation and managed wetlands is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

[1] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[2] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

RECOMMENDATION
• Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation and managed wetlands.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development
Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the Public Outreach and Engagement Plan (Appendix D). We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms. They include attendance at public workshops and updates to the GSP website. There is no specific outreach described for members of the DAC communities.

- The Public Outreach and Engagement Plan does not include outreach and engagement that is specifically directed to environmental stakeholders.

RECOMMENDATION
• Include a more detailed and robust Public Outreach and Engagement Plan that describes active and targeted outreach to engage DAC members, domestic well owners, and environmental stakeholders during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the subbasin are required when defining undesirable results[4] and establishing minimum thresholds.[5,6]

[3] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]
[4] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
[5] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[6] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP does not specifically analyze direct and indirect impacts on DACs and drinking water users when defining undesirable results, or evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders. As discussed above in our comments under Section 1A (Identification of Key Beneficial Uses and Users), these stakeholders were not sufficiently identified in the subbasin.

Identified constituents of concern (COCs) in the subbasin are TDS, sulfate, chloride, boron, nitrate, and total coliform bacteria. No SMC are set for the degraded water quality sustainability indicator in the subbasin. The GSP states (p. 3-14): "Minimum thresholds for significant and unreasonable degradation of groundwater quality were not established for the Subbasin because the groundwater quality in the Subbasin was impacted by industrial activity prior to 2015." However, the GSA should ensure that there is sufficient monitoring for these contaminants to ensure that groundwater use and groundwater management within the basin does not lead to groundwater quality degradation.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for chronic lowering of groundwater levels.
- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs and drinking water users within the subbasin. Further describe the impact of passing the minimum threshold for drinking water users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.

Degraded Water Quality

- Establish a monitoring network for the degraded water quality sustainability indicator to ensure that groundwater use and groundwater management does not lead to groundwater quality degradation within the basin.
- Evaluate the cumulative or indirect impacts of degraded water quality on DACs and drinking water users.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Because the shallow aquifer is disregarded as a principal aquifer in the GSP, SMC provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP states (p. 3-8): "Potential wetlands, shallow groundwater (less than 30 feet), and GDEs have been identified in the PCH Unit and BWER in the Subbasin (Section 2.4.7, Groundwater Dependent Ecosystems). Depletion of groundwater supporting these areas is not currently occurring and will not occur as a result of groundwater production because the groundwater that supports the GDE habitats occurs within the Bellflower aquitard, a shallow surface layer that is hydraulically disconnected from the underlying Ballona and Silverado aquifers in much, though not all, of the Subbasin." However, the GSP has not provided sufficient supporting information for the claim that the aquifers are not connected. The GSP uses groundwater depths in the center of the subbasin from the Ballona and Silverado aquifers to compare to shallow groundwater measurements near the Ballona Creek wetlands in the southern portion of the subbasin to dismiss the connection between the aquifers.

Therefore, the GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater or surface water when defining undesirable results. This is problematic because without identifying potential impacts to GDEs and beneficial users of interconnected surface waters, minimum thresholds may compromise, or even destroy, environmental beneficial users. Since potential GDEs and ISWs are present in the subbasin, they must be considered when developing SMC for the subbasin.

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[7] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[8] can be determined.

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when defining minimum thresholds in the subbasin[9]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,10].

[7] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[8] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[9] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]
[10] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[11] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the GSP did not consider the 2030 or 2070 extremely wet and extremely dry climate scenarios in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

The GSP included climate change into precipitation, evapotranspiration, and sea level inputs of the projected water budget. However, climate change was not incorporated into surface water flow inputs. Furthermore, the GSP does not calculate a sustainable yield based on the projected water budget with climate change incorporated, but instead states that the sustainable yield is based on a historical range of estimates until data gaps are filled. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems and DACs.

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change into surface water flow inputs for the projected water budget.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

[11] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, GDEs, and ISWs. Figure 3-7 (Future/Potential New Monitoring Network Wells) shows that no existing or new proposed monitoring wells are located across large portions of the subbasin, including near GDEs, ISWs, or DACs. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[12].

RECOMMENDATIONS

- Provide maps that overlay monitoring well locations with the locations of DACs, domestic wells, GDEs, and ISWs to clearly identify potentially impacted areas. Increase the number of representative monitoring points (RMPs) in the shallow aquifer across the basin for all groundwater condition indicators. Prioritize proximity to GDEs, ISWs, DACs, and drinking water users when identifying new RMPs.
- Provide specific plans to fill data gaps in the monitoring network. Evaluate how the gathered data will be used to identify and map GDEs and ISWs, and identify DACs and shallow domestic well users that are vulnerable to undesirable results.
- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**. due to the failure to completely identify benefits or impacts of identified projects and management actions to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users. The plan states that public notice is not required for Management Action 1 & 5 because the action would be undertaken under the City of Santa Monica's authority.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

[12] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[13].

- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

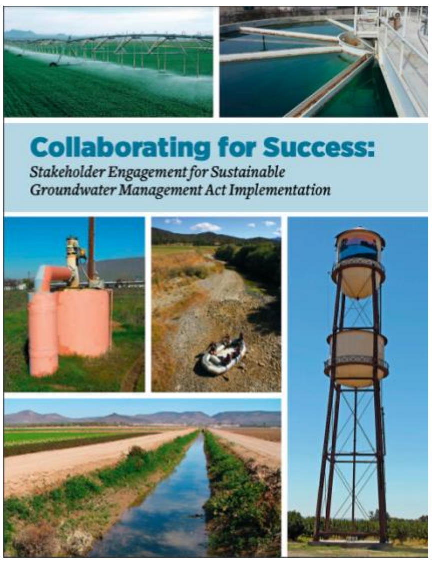
- Ensure that public notice and avenue for stakeholder engagement is provided before undertaking all proposed management actions.

[13] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

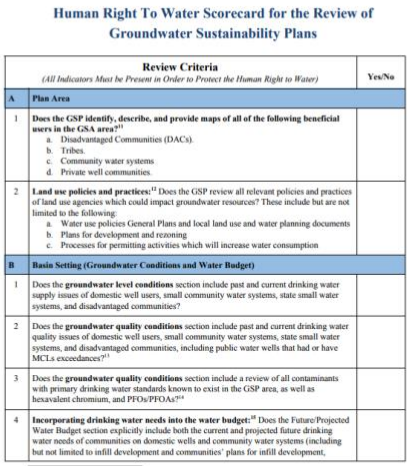
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

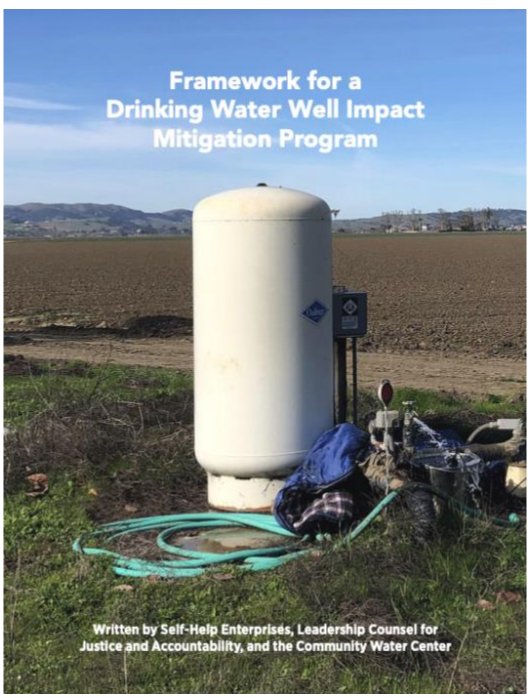


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria (All Indicators Must be Present in Order to Protect the Human Right to Water)	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

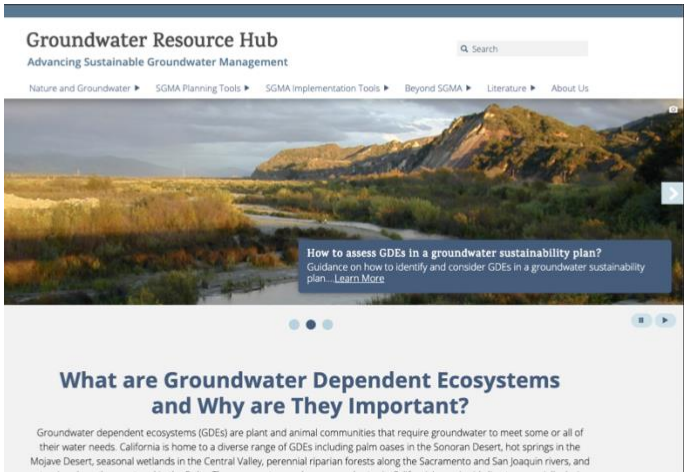
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



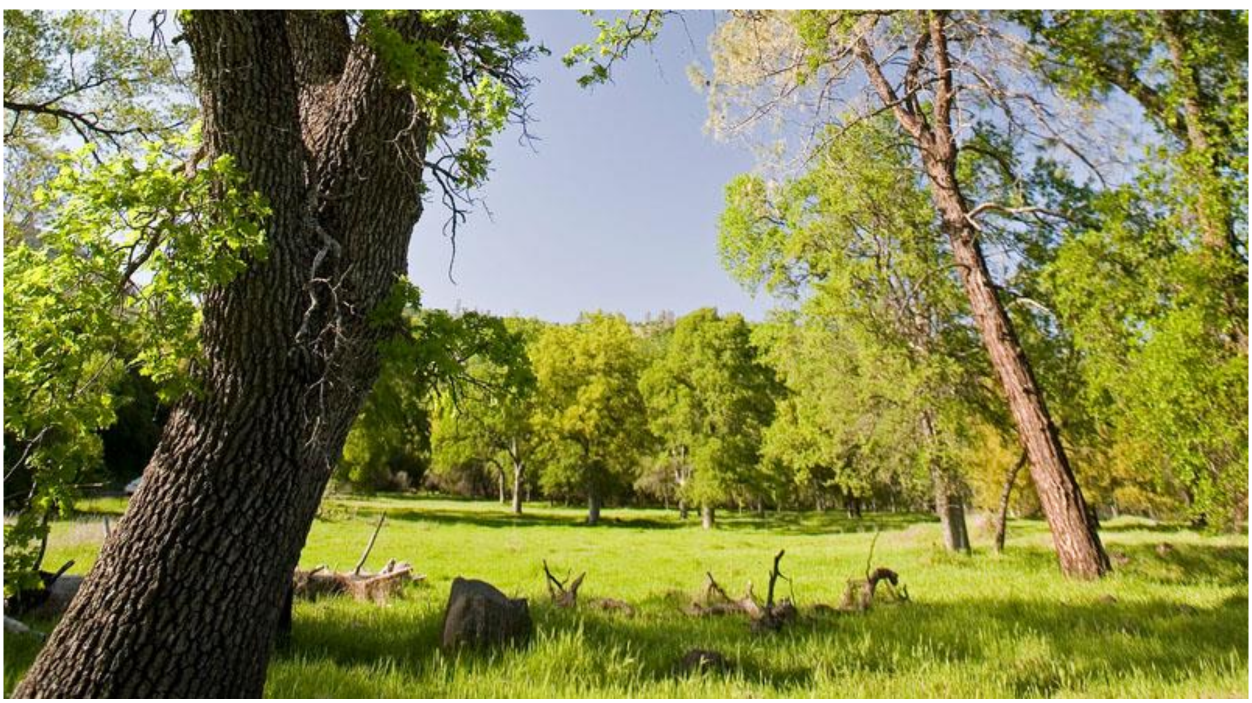
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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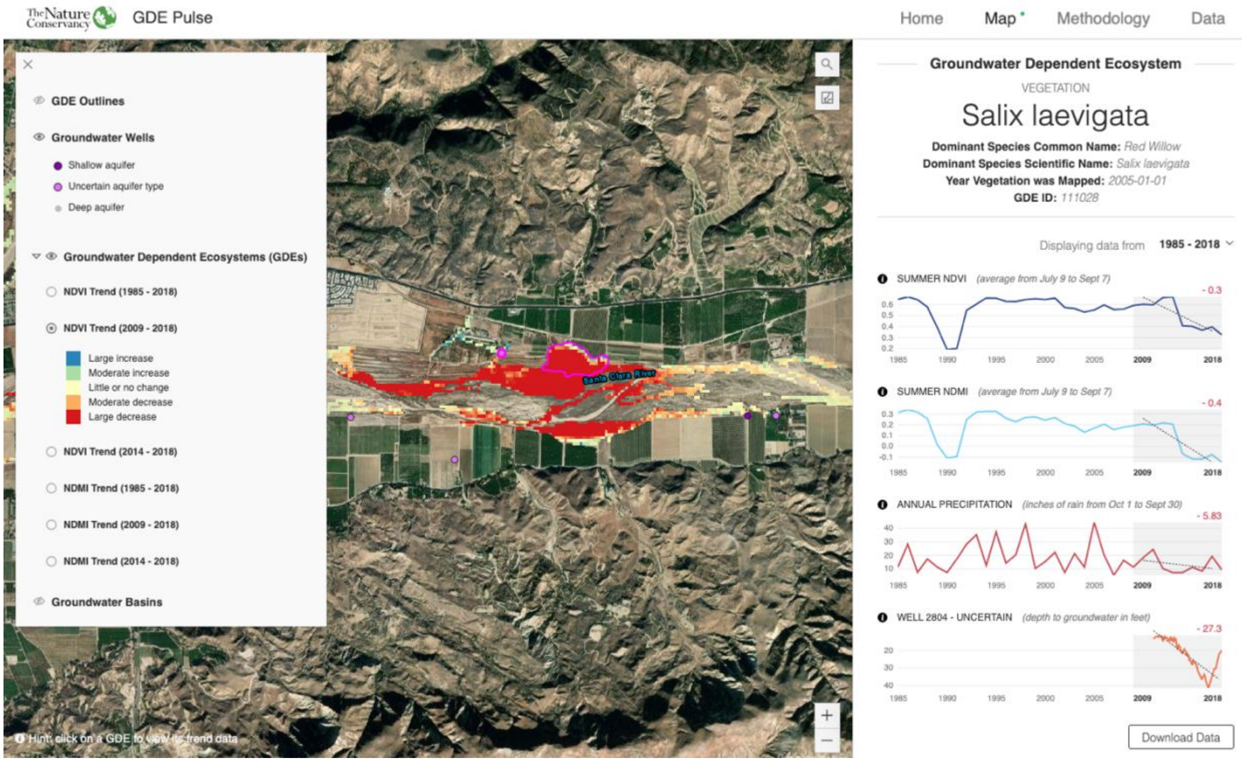
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

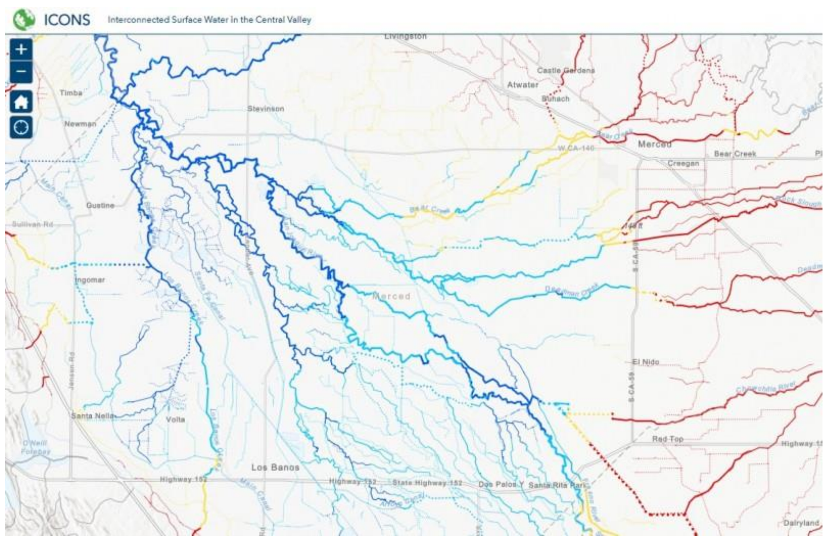
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Santa Monica Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Santa Monica Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Histrionicus histrionicus	Harlequin Duck		Special Concern	BSSC - Second priority
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			

Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Rynchops niger	Black Skimmer			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Americorophium spp.	Americorophium spp.			
Cyprididae fam.	Cyprididae fam.			
Hyalella spp.	Hyalella spp.			
Stygobromus spp.	Stygobromus spp.			
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC

Anaxyrus boreas boreas	Boreal Toad			
Pseudacris cadaverina	California Treefrog			ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Pseudacris regilla	Northern Pacific Chorus Frog			
Rana aurora	Northern Red-legged Frog		Special Concern	ARSSC
INSECTS & OTHER INVERTS				
Aeshna spp.	Aeshna spp.			
Agabus spp.	Agabus spp.			
Anax junius	Common Green Darner			
Apedilum spp.	Apedilum spp.			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Brillia spp.	Brillia spp.			
Callibaetis spp.	Callibaetis spp.			
Chironomidae fam.	Chironomidae fam.			
Conchapelopia spp.	Conchapelopia spp.			
Corisella inscripta				Not on any status lists
Corixidae fam.	Corixidae fam.			
Cricotopus bicinctus				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cricotopus trifascia				Not on any status lists
Dicrotendipes spp.	Dicrotendipes spp.			
Dytiscidae fam.	Dytiscidae fam.			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila spp.	Hydroptila spp.			

Hydroptilidae fam.	Hydroptilidae fam.			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Labrundinia spp.	Labrundinia spp.			
Lepidostoma spp.	Lepidostoma spp.			
Limnophyes spp.	Limnophyes spp.			
Meringodixa chalonensis				Not on any status lists
Micropsectra spp.	Micropsectra spp.			
Microtendipes spp.	Microtendipes spp.			
Nanocladius spp.	Nanocladius spp.			
Pantala hymenaea	Spot-winged Glider			
Paracymus spp.	Paracymus spp.			
Paraleptophlebia spp.	Paraleptophlebia spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Peltodytes spp.	Peltodytes spp.			
Pentaneura spp.	Pentaneura spp.			
Polypedilum spp.	Polypedilum spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Psychodidae fam.	Psychodidae fam.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Tanytarsus spp.	Tanytarsus spp.			
Thienemannimyia spp.	Thienemannimyia spp.			
Tinodes spp.	Tinodes spp.			
MOLLUSKS				
Assiminea californica				Not on any status lists
Gyraulus spp.	Gyraulus spp.			
Helisoma spp.	Helisoma spp.			
Lymnaea spp.	Lymnaea spp.			
Menetus spp.	Menetus spp.			
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Pyrgulopsis spp.	Pyrgulopsis spp.			
PLANTS				
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Baccharis salicina				Not on any status lists
Batis maritima	Saltwort			

Bolboschoenus maritimus paludosus	NA			Not on any status lists
Bolboschoenus robustus				Not on any status lists
Cicuta douglasii	Western Water-hemlock			
Cotula coronopifolia	NA			
Cyperus involucratus	NA			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Euthamia occidentalis	Western Fragrant Goldenrod			
Helenium puberulum	Rosilla			
Jaumea carnosa	Fleshy Jaumea			
Juncus acutus leopoldii	Spiny Rush		Special	CRPR - 4.2
Limonium californicum	California Sea-lavender			
Mimulus guttatus	Common Large Monkeyflower			
Oenanthe sarmentosa	Water-parsley			
Phacelia distans	NA			
Platanus racemosa	California Sycamore			
Rumex fueginus				Not on any status lists
Rumex salicifolius salicifolius	Willow Dock			
Ruppia maritima	Ditch-grass			
Sagittaria montevidensis calycina				Not on any status lists
Salicornia bigelovii	Dwarf Glasswort			
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Schoenoplectus americanus	Three-square Bulrush			
Schoenoplectus californicus	California Bulrush			
Sidalcea neomexicana	Rocky Mountain Checker-mallow		Special	CRPR - 2B.2
Sinapis alba	NA			

Stachys ajugoides	Bugle Hedge-nettle			
Suaeda calceoliformis	American Sea-blite			
Suaeda californica	California Sea-blite	Endangered	Special	CRPR - 1B.1
Suaeda esteroa	Estuary Suaeda		Special	CRPR - 1B.2
Triglochin maritima	Common Bog Arrow-grass			
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

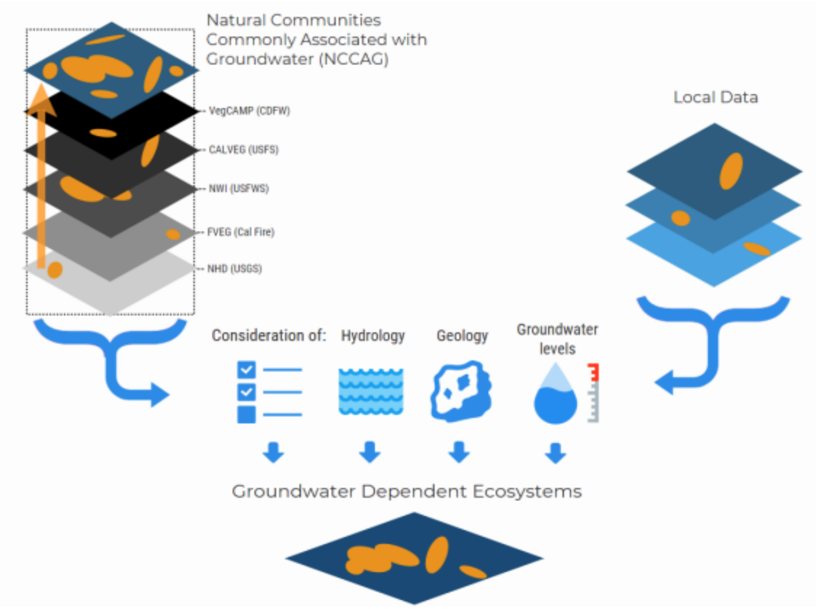


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

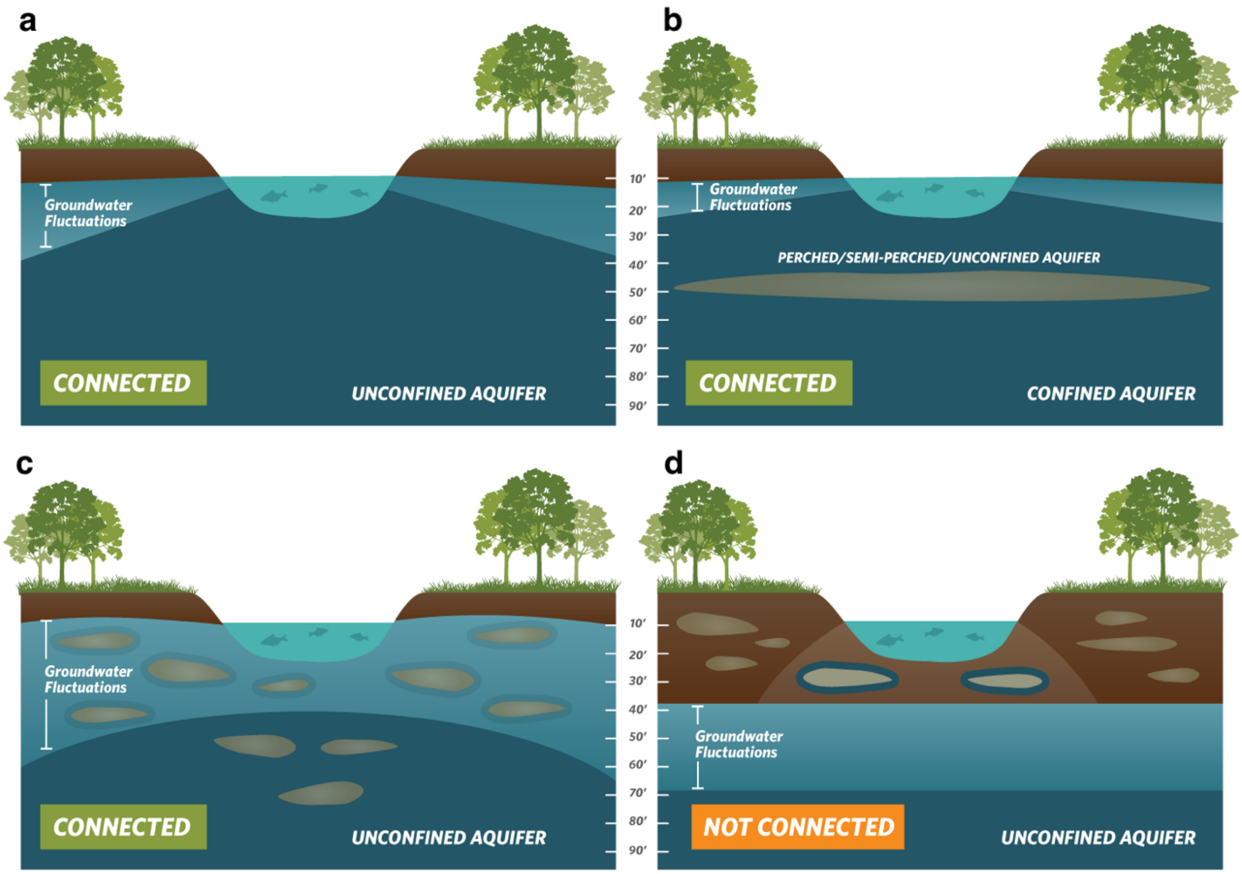

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

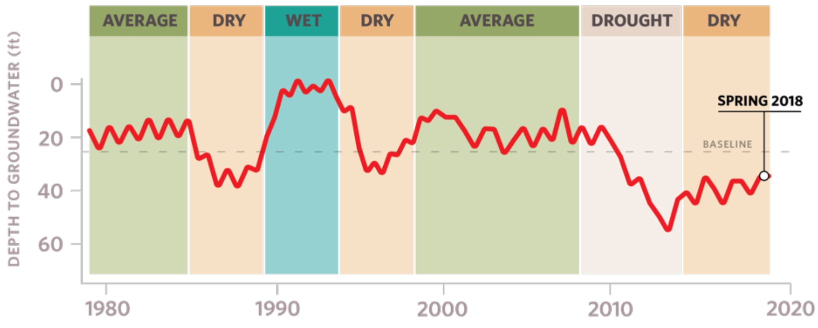

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

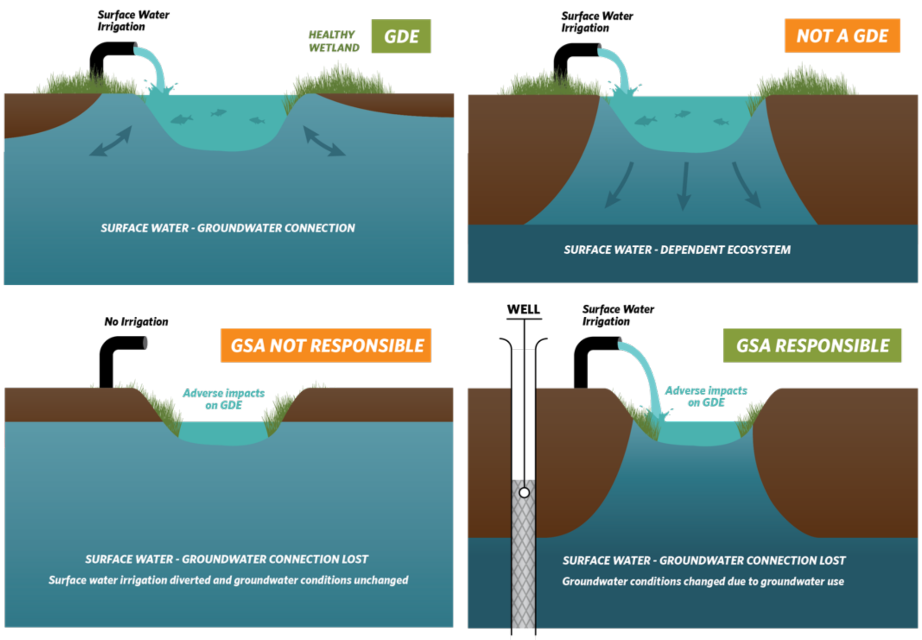

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

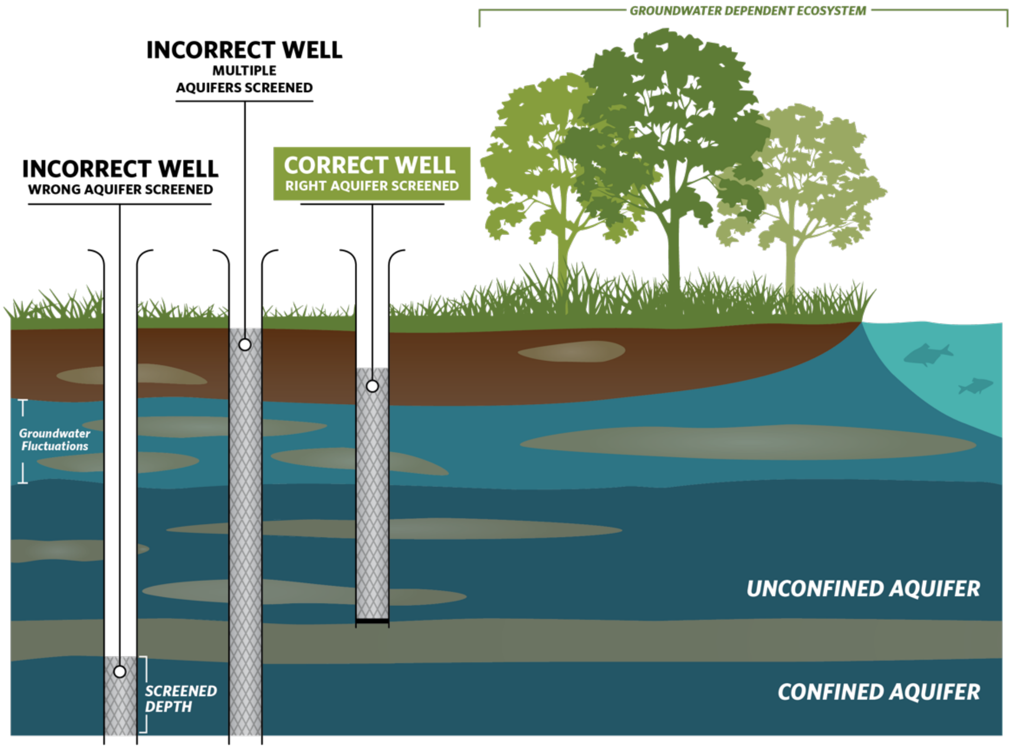

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

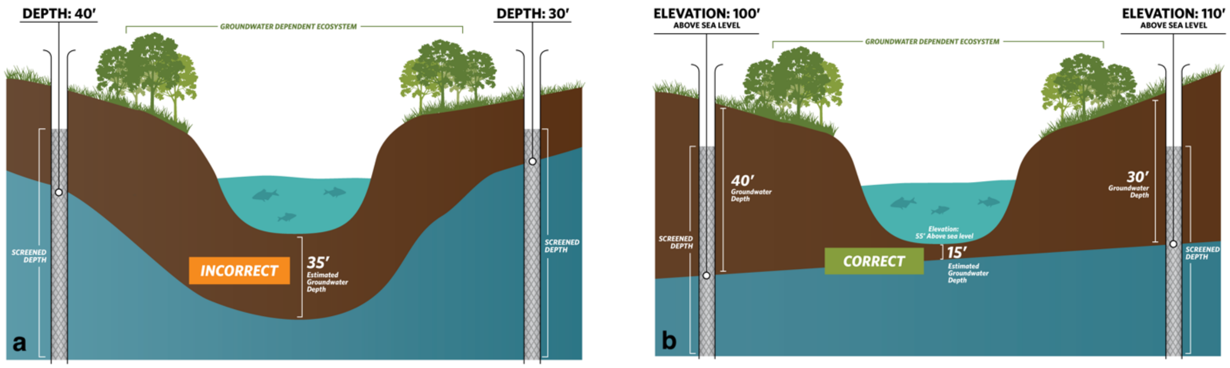

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

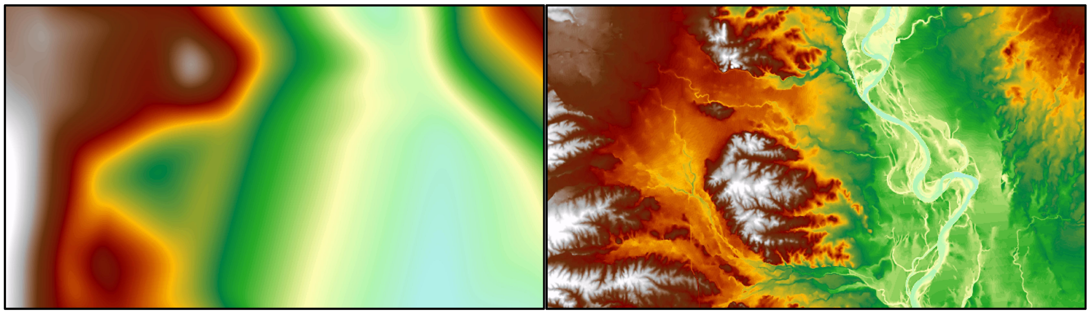

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

October 31, 2021

Santa Rosa Plain GSA
2235 Mercury Way, Suite 105
Santa Rosa, CA 95407

Submitted via web: *https://santarosaplaingroundwater.org/document-comments/*

Re: Public Comment Letter for Santa Rosa Plain Groundwater Subbasin Draft GSP

Dear Ann DuBay,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Santa Rosa Plain Groundwater Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.

2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Santa Rosa Plain Groundwater Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Santa Rosa Plain Groundwater Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. Tribal lands have been identified and mapped (Figure 2-3) within the subbasin. The GSP provides the percentage of the subbasin's population that is categorized as DACs and identifies DACs within the subbasin by name. However, we note the following deficiencies with the identification of these key beneficial users:

- The plan fails to map the locations of DACs or provide the population of each DAC. The plan fails to explicitly identify the population of DACs dependent on groundwater as their source of drinking water in the subbasin.

- The GSP includes a map of water wells in the subbasin (Figure 2-6). However, the map groups all wells together and does not differentiate between well types such as domestic, irrigation, or industrial wells. Additionally, the plan fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide a map of DACs and more information about the population of each identified DAC. Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). • Include a domestic well density map for the subbasin.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

- Include a map showing domestic well locations and average well depth across the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **insufficient**. The GSP uses a multiple-lines-of-evidence approach to assign point values to stream segments based on the following four criteria: (a) depth-to-groundwater along stream channels, spring 2015 (b) percent of time stream is gaining, from 2000 to 2010 (c) median stream flow, from 2000 to 2010 (d) surface leakage, 2006. There are several problems with this approach. The points assigned for each criteria are arbitrary, as is the total point value that determines whether a reach is interconnected or not. Other issues include the following:

- The GSP gives more points to areas of streams where groundwater elevation is higher than the stream bottom elevation. This procedure is completed for one point in time only, spring 2015. Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs. The use of one date does not reflect the temporal (seasonal and interannual) variability inherent in California's climate.

- The GSP gives more points to segments of stream that are gaining throughout the year. Losing streams are not considered in this assessment. This is problematic because stream segments that are interconnected (losing or gaining) for any percentage of time should be considered an ISW.

- The GSP gives more points to streams with flow more than 50% of the time. However, even short durations of flow can indicate interconnected conditions. Note the regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

RECOMMENDATIONS

- Consider stream reaches with connection for any percentage of time as interconnected. On the map of streams in the subbasin, clearly labeled reaches as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.

- Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.

- Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **incomplete**. The GSP maps GDEs using the Sonoma County Veg Map (Sonoma Veg Map 2013), which we agree is the best available data for the subbasin. To identify where the potential GDEs are likely to have connection with groundwater, the rooting depths of common tree species were compared to available depth-to-groundwater data. The GSP states (p. 3-88): *"The DTW mapping utilized available contoured springtime datasets for the shallow aquifer system (from 2015 and 2016) and high-resolution LiDAR data. To address Work Group member concerns that groundwater levels were generally at lower levels in 2015 and 2016 due to dry conditions, minor adjustments in some areas were made to incorporate the shallowest depth-to-water on record for each well based on review of all available data from 2005 to 2020."* However, no further details on the available data from 2005 to 2020 was provided.

The GSP states (p. 3-88): *"Following guidance from TNC, potential vegetation GDEs were mapped for areas with DTW of 30 feet or less to incorporate the potential rooting depths of oak trees (TNC 2018)."* If Valley Oaks exist in the subbasin, we recommend instead that an 80-foot depth-to-groundwater threshold be used when inferring whether Valley Oak polygons in the Veg Map derived potential GDE map are likely reliant on groundwater. This recommendation is based on a recent correction in TNC's rooting depth database,[2] after finding a typo in the max rooting depth units for Valley Oak. This resulted in a specific change in the max rooting depth of Valley Oak from 24 feet to 24 meters (80 feet). For all other phreatophytes, we continue to recommend that a 30-foot depth-to-groundwater threshold be used when inferring whether all other vegetation polygons are likely reliant on groundwater.

RECOMMENDATIONS

- Discuss available shallow groundwater data. Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around Veg Map derived potential GDE polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the Veg Map derived potential GDE map are supported by groundwater in an aquifer.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as Valley Oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used if these species are present in the subbasin. For example, a

[2] TNC. 2021. Plant Rooting Depth Database. Available at: https://groundwaterresourcehub.org/sgma-tools/gde-rooting-depths-database-for-gdes/

depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether Valley Oak polygons are connected to groundwater.

- Further discuss data gaps for GDEs, including specific plans and locations for additional shallow monitoring wells.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[3,4] The integration of native vegetation into the water budget is **insufficient**. The water budget includes a separate item for evapotranspiration, but combines crop, native vegetation, and riparian evapotranspiration into one term. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the subbasin.

RECOMMENDATION

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.
- State whether or not there are managed wetlands in the subbasin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP Development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Community Engagement Plan (Appendix 1-E).[5]

The GSP states that the GSA Advisory Committee includes representatives from tribal and environmental stakeholder communities, and that the Advisory Committee will continue to meet during GSP implementation. However, we note the following deficiencies with the overall stakeholder engagement process:

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[3] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[4] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[5] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- The GSP documents opportunities for public involvement and engagement through monthly informational emails, the GSA website, public forums, presentations to stakeholder groups within the subbasin, a rural community engagement program with well owners, and GSA Board, Advisory Committee and community meetings. There is no explicit identification of a DAC representative on the Advisory Committee or other outreach targeted to DACs and drinking water users.

- Other than representation on the Advisory Committee, outreach to tribes and environmental stakeholders is described in general terms. The role that the Advisory Committee plays during the GSP *implementation* process is unclear.

RECOMMENDATIONS

- In the Community Engagement Plan, describe active and targeted outreach to engage DACs and domestic well owners throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Provide more information on the role of the Advisory Committee during the GSP implementation process.

- Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the subbasin within the GSP.[6]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[7,8,9]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP presents a well impact study to consider the potential impacts on existing well users (p. 4-14). The well impact study is not clearly presented, but appears to group all wells together (i.e., domestic wells, irrigation wells, public supply wells, and industrial wells), use the 98th percentile shallowest supply well total depth, then add a 'drought factor' as follows (p. 4-15): *"For wells with 10 or more years of historical data, the largest*

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[6] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[7] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[8] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[9] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

consecutive 4-year decline during historical dry periods was used; For wells with less than 10 years of historical data, the future simulated largest consecutive 4-year decline was used." The minimum thresholds are then set as follows (p. 4-21): *"MTs for chronic lowering of groundwater levels are set at the more protective of historical low conditions with allowances for future droughts and the depths at which existing wells could be impacted by lowering of groundwater levels."*

Despite this analysis, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold, and whether the undesirable results are consistent with the Human Right to Water policy.[10] In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, nor does it describe how the groundwater level minimum thresholds are consistent with Human Right to Water policy and will avoid significant and unreasonable impacts on beneficial users.

The GSP identifies arsenic, nitrate, and salinity (measured as total dissolved solids, TDS) as constituents of concern (COCs) for the subbasin. Minimum thresholds are based on a number of supply wells that exceed concentrations of constituents determined to be of concern for the Subbasin. The concentrations are set at the maximum contaminant level (MCL) for arsenic and nitrate and the secondary MCL for TDS. The GSP states (p. 4-29): *"There are other point source contaminants found sporadically in the Subbasin, but these are not regional in extent, are monitored through various other regulatory programs, and consequently SMC are not established in the GSP. New or additional water quality constituents may be identified as potential COCs applicable to the GSP implementation activities through routine consultation and information sharing with other regulatory agencies. The GSA would then consider adding potential COCs and assigning SMC during the 5-year GSP updates."* However, SMC should be established for all COCs in the subbasin impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

The GSP only includes a very general discussion of impacts to drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs, drinking water users, or tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs, drinking water users, or tribes.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

Degraded Water Quality

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when defining undesirable results for degraded water quality. For specific guidance on how to

[10] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[11]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs, drinking water users, and tribes.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that are impacted by groundwater use and/or management. Ensure they align with drinking water standards.[12]

Groundwater Dependent Ecosystems and Interconnected Surface Waters

For chronic lowering of groundwater levels, when describing effects on beneficial uses and users (Section 4.5.2.4) the GSP states (p. 4-21): *"Maintaining groundwater near or above historical levels will help maintain the interconnected nature of groundwater and surface water in the Subbasin. This will protect GDE habitat and generally benefit environmental land uses and users."* No analysis or discussion is provided in the GSP that describes impacts on GDEs or establishes SMC for GDEs that are directly dependent on groundwater. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC for chronic lowering of groundwater levels.

For depletion of interconnected surface water, Appendix 4-C (Development of Sustainable Management Criteria of Interconnected Surface Water) describes the methodology for establishing SMC. The appendix states (p. 3): *"Based on input from the Depletion of Interconnected Surface Water Work Group, as well from the SRP Advisory Committee and Board, it was determined that MT values at RMP locations should be sufficiently protective so as to not exceed the average, basin-wide, dry-season (July–September) surface water depletion from pumping that occurred during the three years with the greatest depletion over the 2004–2018 evaluation period. As shown in Fig. 19, the three years with the greatest simulated depletion were 2014, 2015, and 2016. Accordingly, the resultant MT is more protective than if the MT were chosen to reflect the single year with the greatest depletion."* To describe impacts on beneficial users of ISW, the GSP states (p. 4-56): *"If depletions of interconnected surface water were to reach undesirable results, adverse effects could include the reduced ability of the streamflows to meet instream flow requirements for local fisheries and critical habitat in the Subbasin. Reduced surface flows can also negatively affect permitted surface water diversions. Consideration of the above was included as part of SMC development."* However, no analysis or discussion is presented to describe how the SMC will affect beneficial users, and more specifically GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (e.g., steelhead; see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

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[11] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[12] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin.[13] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[14]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[15] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,16]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[17] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more

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[13] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[14] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[15] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[16] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[17] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

on groundwater during times of drought.[18] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using RCP 8.5 and the HadGEM2-ES Global Climate Model. However, the GSP does not consider extreme climate scenarios in the projected water budget. We encourage you to consider other GCM projections. While HadGEM2-ES may better represent median conditions, other models may better capture other statistics relevant for your basin and may reveal valuable information to account for uncertainty. In addition, the GSP should clearly and transparently incorporate extremely wet and dry scenarios or select more appropriate extreme scenarios for their subbasin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP incorporates climate change into key inputs (e.g., precipitation, evapotranspiration) of the projected water budget. However, imported water should also be adjusted for climate change and incorporated into the surface water flow inputs of the projected water budget. The sustainable yield is calculated based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of extreme climate scenarios and the omission of projected climate change effects on imported water inputs, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, domestic well owners, and tribes.

RECOMMENDATIONS

- Consider other GCM projections to account for uncertainty beyond median statistics.
- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change into surface water flow inputs, including imported water, for the projected water budget.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, and tribes in the subbasin.

[18] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

Figure 5-3a (Representative Monitoring Point Network for Chronic Lowering of Groundwater Levels – Shallow Aquifer System) shows insufficient representation of DACs, drinking water users, and tribal users for groundwater elevation monitoring. Figure 5-4 (Representative Monitoring Point Network for Degraded Water Quality) shows insufficient representation of DACs, drinking water users, and tribal users for water quality monitoring. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[19]

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations (specifying whether they are shallow or deep wells) with the locations of DACs, domestic wells, tribes, GDEs, and ISWs to clearly identify monitored areas.
- Increase the number of RMPs in the shallow aquifer across the subbasin as needed to adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, tribes, and GDEs when identifying new RMPs.
- Ensure groundwater elevation and water quality RMPs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, tribes, and GDEs.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, drinking water users, and tribes. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

The management actions described in Section 6.4.1 (Coordination of Farm Plans with GSP Implementation) and Section 6.4.3 (Assessment of Potential Policy Options for GSA Consideration) describe improvement to water quality through sediment runoff mitigation and water quality sampling. The GSP specifically describes projects with benefits to GDEs, including the Stormwater Capture and Recharge Project described in Section 6.2.2. However, the plan fails to identify or describe projects or management action with explicit benefits to DACs or drinking water users, including a domestic well mitigation program.

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[19] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document".[20]

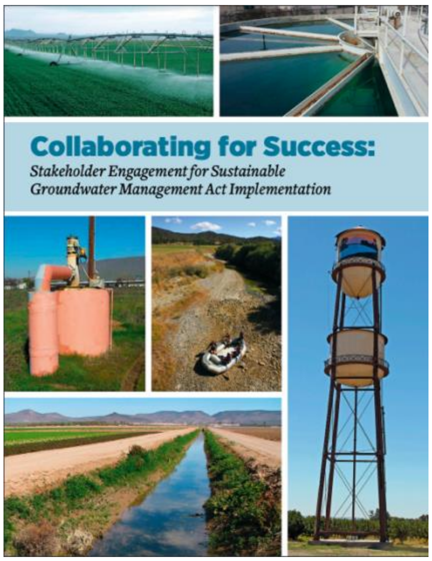
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[20] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

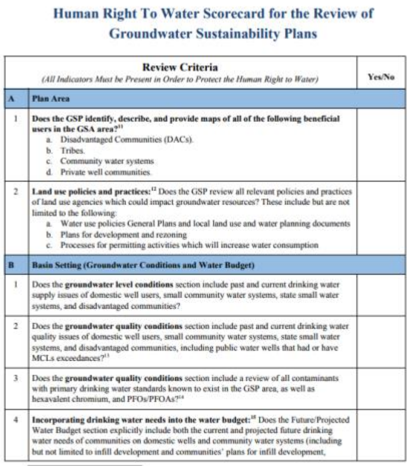
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

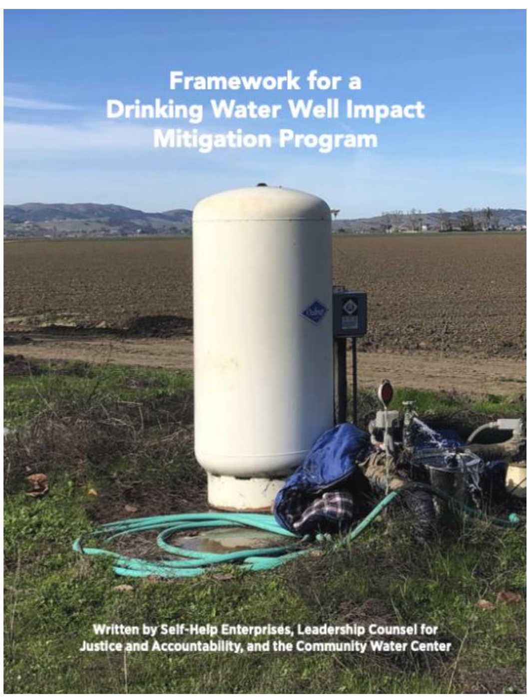


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

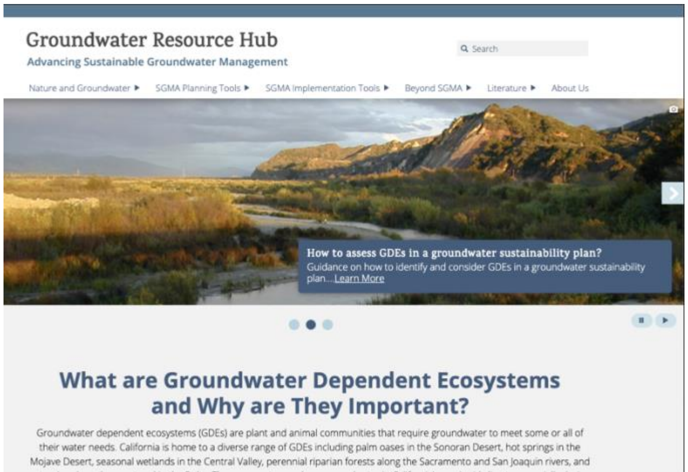
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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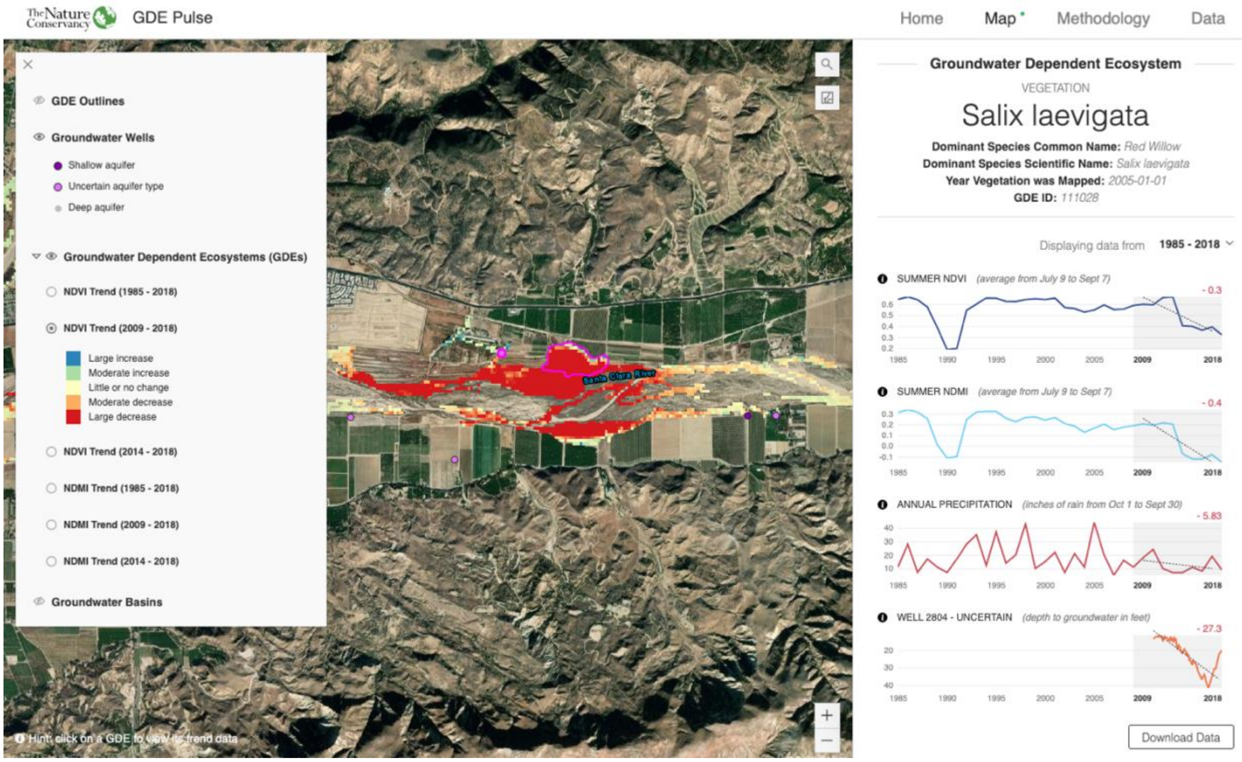
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

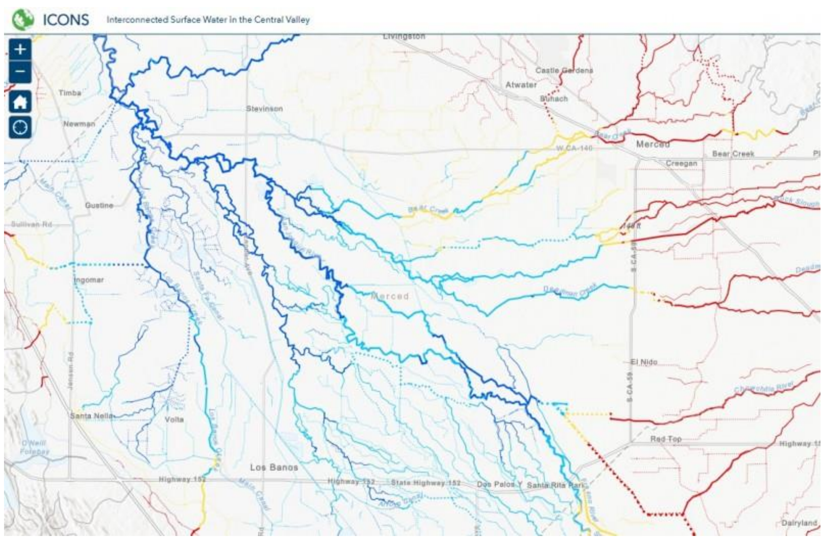
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Santa Rosa Valley - Santa Rosa Plain Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Santa Rosa Valley - Santa Rosa Plain Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Laterallus jamaicensis coturniculus	California Black Rail	Bird of Conservation Concern	Threatened	
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			

Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Plegadis chihi	White-faced Ibis		Watch list	
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
CRUSTACEANS				
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
Hyalella azteca	An Amphipod			
Hyalella spp.	Hyalella spp.			
FISHES				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus mykiss - CCC winter	Central California coast winter steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CCC fall	California Coast fall Chinook salmon	Threatened	Special	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense "Sonoma"	Sonoma Tiger Salamander	Endangered		Not on any status lists
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Dicamptodon ensatus	California Giant Salamander			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC

Taricha granulosa	Rough-skinned Newt			
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Anaxyrus boreas halophilus	California Toad			ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
Pseudacris sierra	Sierran Treefrog			
Thamnophis atratus atratus	Santa Cruz Gartersnake			Not on any status lists
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis sirtalis infernalis	California Red-sided Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Ablabesmyia annulata				Not on any status lists
Ablabesmyia spp.	Ablabesmyia spp.			
Anax junius	Common Green Darner			
Archilestes grandis	Great Spreadwing			
Argia vivida	Vivid Dancer			
Callibaetis californicus	A Mayfly			
Callibaetis spp.	Callibaetis spp.			
Cheumatopsyche analis				Not on any status lists
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corixidae fam.	Corixidae fam.			
Dicosmoecus gilvipes	A Caddisfly			
Dubiraphia brunnescens	Brownish Dubiraphian Riffle Beetle		Special	
Dubiraphia spp.	Dubiraphia spp.			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Epitheca canis	Beaverpond Baskettail			
Erythemis collocata	Western Pondhawk			
Fallceon quilleri	A Mayfly			
Gomphus kurilis	Pacific Clubtail			

Gumaga nigricula	A Bushtailed Caddisfly			
Hydropsyche alternans				Not on any status lists
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila ajax	A Caddisfly			
Hydroptila spp.	Hydroptila spp.			
Ischnura cervula	Pacific Forktail			
Ischnura perparva	Western Forktail			
Lepidostoma acarolum				Not on any status lists
Lepidostoma spp.	Lepidostoma spp.			
Lestes stultus	Black Spreadwing			
Libellula forensis	Eight-spotted Skimmer			
Libellula luctuosa	Widow Skimmer			
Libellula pulchella	Twelve-spotted Skimmer			
Libellula saturata	Flame Skimmer			
Micropsectra nigripila				Not on any status lists
Micropsectra spp.	Micropsectra spp.			
Mideopsis pumila				Not on any status lists
Mideopsis spp.	Mideopsis spp.			
Mystacides alafimbriatus	A Caddisfly			
Namamyia plutonis	A Caddisfly			
Ophiogomphus arizonicus				Not on any status lists
Ophiogomphus spp.	Ophiogomphus spp.			
Optioservus canus	Pinnacles Optioservus Riffle Beetle		Special	
Optioservus spp.	Optioservus spp.			
Orthocladius appersoni				Not on any status lists
Orthocladius spp.	Orthocladius spp.			
Pachydiplax longipennis	Blue Dasher			
Parakiefferiella spp.	Parakiefferiella spp.			
Parakiefferiella subaterrima				Not on any status lists
Paraleptophlebia altana	A Mayfly			
Paraleptophlebia spp.	Paraleptophlebia spp.			
Pentaneura inconspicua				Not on any status lists
Pentaneura spp.	Pentaneura spp.			
Plathemis lydia	Common Whitetail			

Polypedilum albicorne				Not on any status lists
Polypedilum spp.	Polypedilum spp.			
Procladius barbatulus				Not on any status lists
Procladius spp.	Procladius spp.			
Rheotanytarsus hamatus				Not on any status lists
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna californica	California Darner			
Rhionaeschna multicolor	Blue-eyed Darner			
Rhyacophila grandis	A Caddisfly			
Rhyacophila harmstoni	A Caddisfly			
Sialis arvalis				Not on any status lists
Sialis spp.	Sialis spp.			
Sigara alternata				Not on any status lists
Sigara mckinstryi	A Water Boatman			Not on any status lists
Sigara spp.	Sigara spp.			
Sperchon spp.	Sperchon spp.			
Sperchon stellata				Not on any status lists
Sympetrum corruptum	Variegated Meadowhawk			
Sympetrum illotum	Cardinal Meadowhawk			
Sympetrum madidum	Red-veined Meadowhawk			
Sympetrum occidentale				Not on any status lists
Tramea lacerata	Black Saddlebags			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
Zaitzevia parvula				Not on any status lists
Zaitzevia spp.	Zaitzevia spp.			
Ameletus vancouverensis	A Mayfly			
Baetis piscatoris	A Mayfly			
MAMMALS				
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
MOLLUSKS				

Anodonta californiensis	California Floater		Special	
Ferrissia fragilis	Fragile Ancylid			CS
Ferrissia spp.	Ferrissia spp.			
Galba spp.	Galba spp.			
Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus circumstriatus	Disc Gyro			CS
Gyraulus spp.	Gyraulus spp.			
Helisoma spp.	Helisoma spp.			
Lymnaea spp.	Lymnaea spp.			
Margaritifera falcata	Western Pearlshell		Special	
Menetus opercularis	Button Sprite			CS
Menetus spp.	Menetus spp.			
Physa acuta	Pewter Physa			Not on any status lists
Physa spp.	Physa spp.			
Planorbella binneyi	Coarse Rams-horn			CS
Planorbella spp.	Planorbella spp.			
PLANTS				
Blennosperma bakeri	Baker's Blennosperma	Endangered	Endangered	CRPR - 1B.1
Downingia pusilla	Dwarf Downingia		Special	CRPR - 2B.2
Lasthenia burkei	Burke's Goldfields	Endangered	Endangered	CRPR - 1B.1
Limnanthes vinculans	Sebastopol Meadowfoam	Endangered	Endangered	CRPR - 1B.1
Navarretia leucocephala bakeri	Baker's Navarretia		Special	CRPR - 1B.1
Navarretia leucocephala plieantha	Many-flower Navarretia	Endangered	Endangered	CRPR - 1B.2
Arundo donax	NA			
Baccharis salicina				Not on any status lists
Beckmannia syzigachne	American Sloughgrass			
Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche marginata	Winged Water-starwort			
Calochortus uniflorus	Shortstem Mariposa Lily		Special	CRPR - 4.2
Carex densa	Dense Sedge			
Damasonium californicum				Not on any status lists
Downingia concolor	NA			

Eryngium aristulatum aristulatum	California Eryngo			
Euthamia occidentalis	Western Fragrant Goldenrod			
Gratiola ebracteata	Bractless Hedge-hyssop			
Juncus effusus pacificus				
Legenere limosa	False Venus'-looking-glass		Special	CRPR - 1B.1
Limnanthes alba alba	White Meadowfoam			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limnanthes douglasii nivea	Douglas' Meadowfoam			
Ludwigia hexapetala	NA			Not on any status lists
Mimulus tricolor	Tricolor Monkeyflower			
Myriophyllum aquaticum	NA			
Navarretia cotulifolia	Cotula Navarretia			
Navarretia intertexta	Needleleaf Navarretia			
Oenanthe sarmentosa	Water-parsley			
Perideridia kelloggii	Kellogg's Yampah			
Persicaria pensylvanica	NA			Not on any status lists
Phyla nodiflora	Common Frog-fruit			
Plagiobothrys undulatus	NA			Not on any status lists
Platanus racemosa	California Sycamore			
Pleuropogon californicus californicus				Not on any status lists
Pogogyne douglasii	NA			
Potamogeton illinoensis	Illinois Pondweed			
Ranunculus lobbii	Lobb's Water Buttercup		Special	CRPR - 4.2
Ranunculus pusillus pusillus	Pursh's Buttercup			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Salix exigua exigua	Narrowleaf Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists

Salix lasiolepis lasiolepis	Arroyo Willow			
Scirpus microcarpus	Small-fruit Bulrush			
Sequoia sempervirens				
Sidalcea calycosa calycosa	Annual Checker-mallow			
Sparganium eurycarpum eurycarpum				
Symphyotrichum lentum	Suisun Marsh Aster		Special	CRPR - 1B.2
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	NA			

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

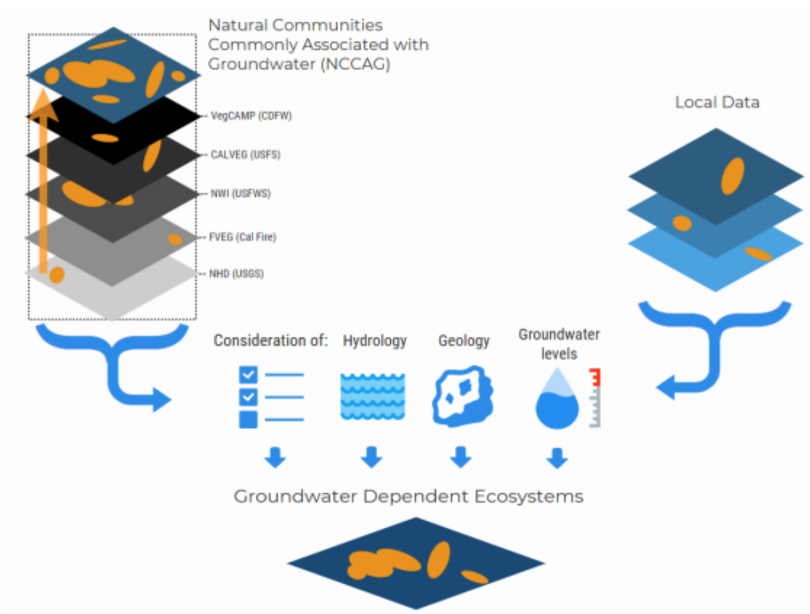


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

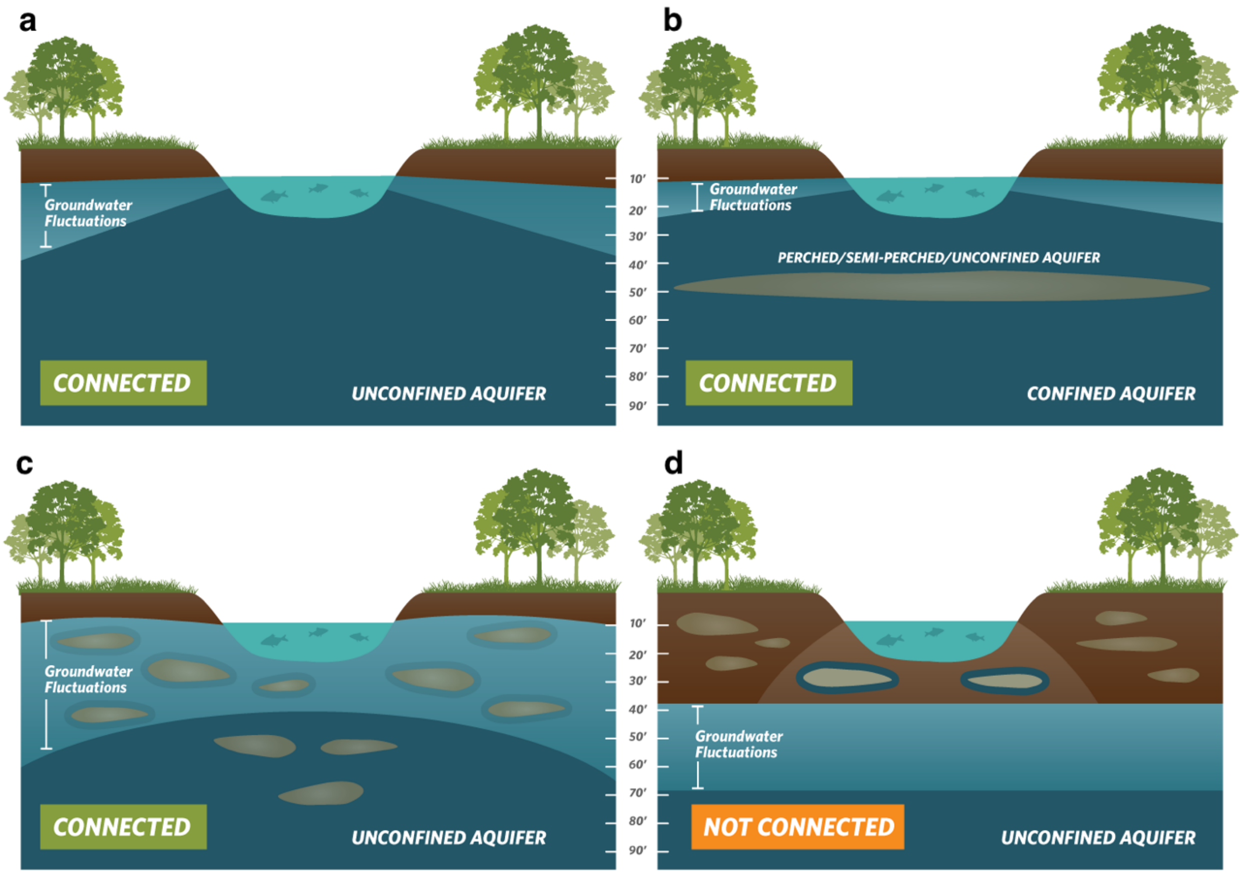

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

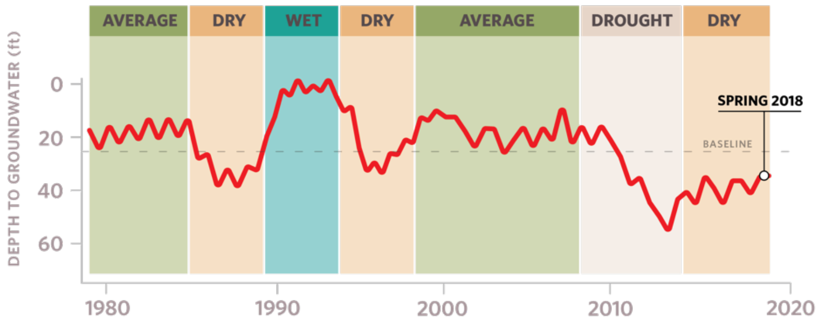

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

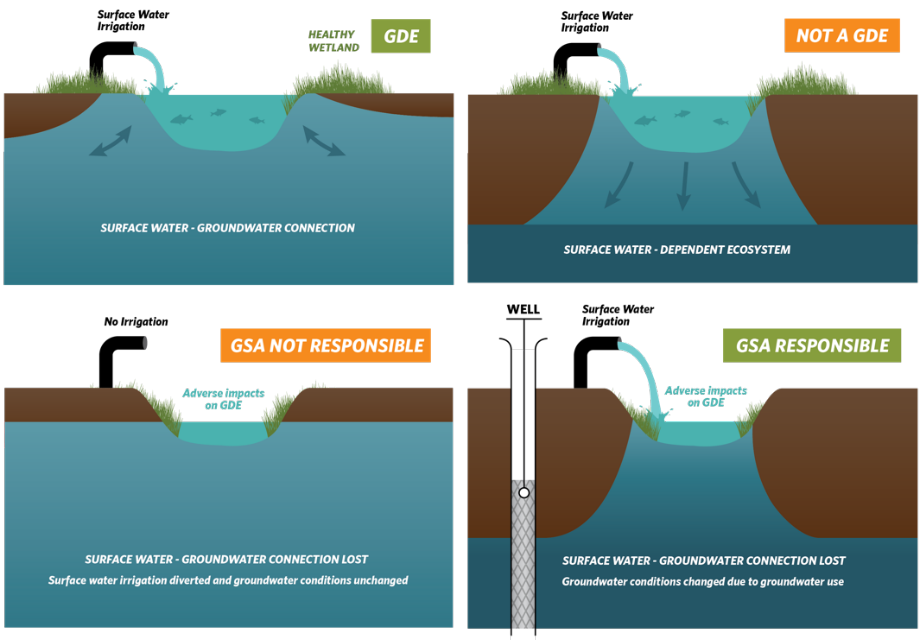

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

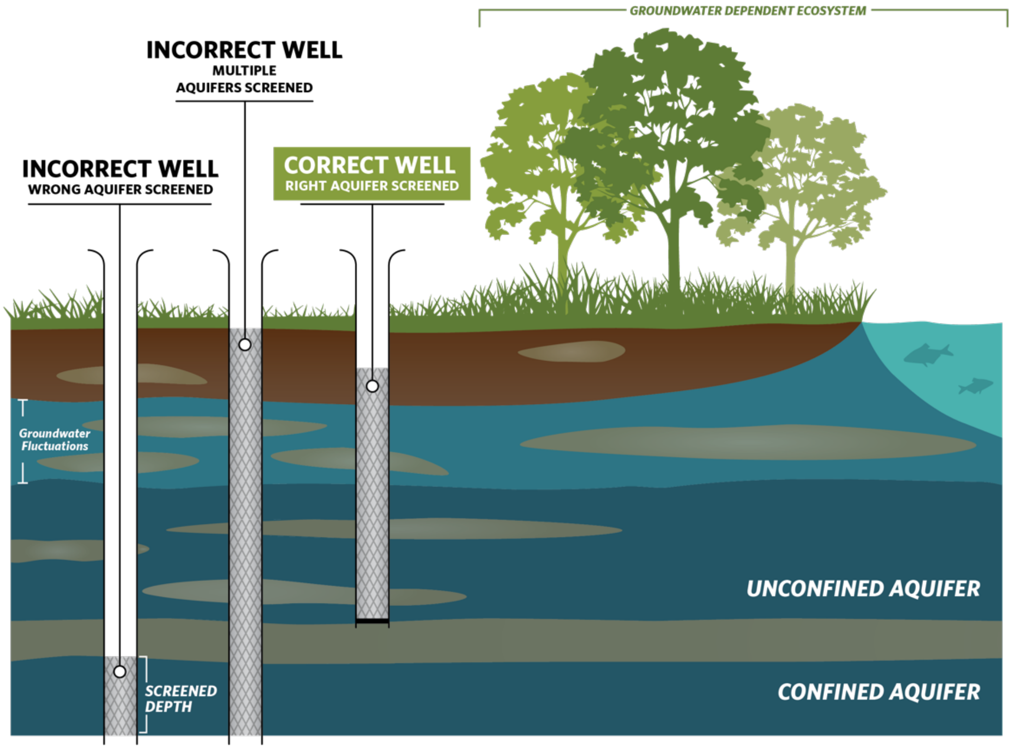

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

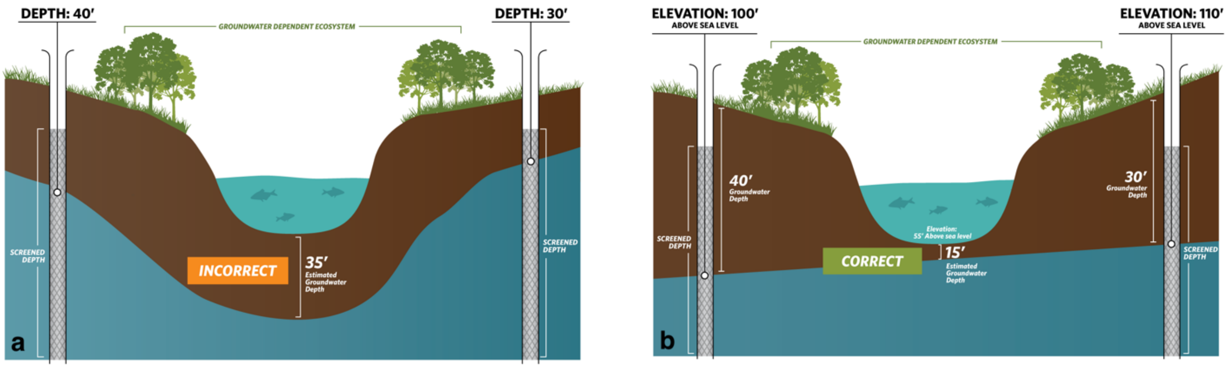

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

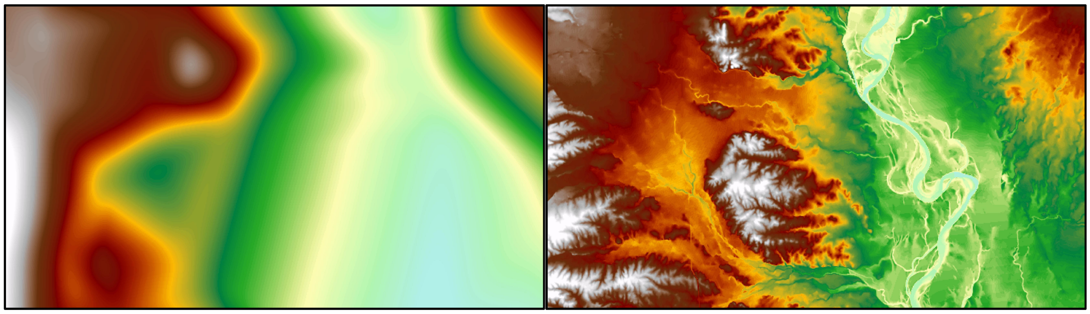

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

October 26, 2021

Santa Ynez River Valley Basin Central Management Area GSA
P.O. BOX 719
Santa Ynez, CA 93460

Submitted via web: https://portal.santaynezwater.org/comment/new?gsaKey=CMA

Re: Public Comment Letter for Santa Ynez River Valley Central Management Area Draft GSP

Dear Bill Buelow,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Santa Ynez River Valley Basin Central Management Area being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Santa Ynez River Valley Central Management Area Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Santa Ynez River Valley Basin
Central Management Area (CMA) Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users
The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. We note the following deficiencies with the identification of these key beneficial users:

- The GSP identifies the City of Buelton as a DAC and describes the size of the population. However, the GSP fails to map the location of the DAC within the CMA.
- While the plan provides a density map of domestic wells in the CMA, the GSP fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range).
- The plan fails to explicitly identify the population dependent on groundwater as their source of drinking water in the CMA.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Map the locations of DACs within the CMA. The DWR DAC mapping tool can be used for this purpose.[2] • Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

[2] The DWR DAC mapping tool is available online at: https://gis.water.ca.gov/app/dacs/.

- Include a map showing domestic well locations and average well depth across the CMA.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis.

The GSP states (p. 2b-35): *"Because the underflow of the Santa Ynez River is considered part of the surface water flowing in a known and definite channel, there is no interconnected surface water in the CMA. The Santa Ynez River surface water and underflows are managed by the SWRCB for the reach of the Santa Ynez River in the CMA and will not be managed under SGMA by the CMA GSA."* The HCM section also states (p. 2a-11): *"The subflow of the Santa Ynez River flowing through the Santa Ynez River alluvium [is] managed by SWRCB pursuant to WR 2019-0148 and other orders and decisions, and is also not a principal aquifer."* However, no further explanation or discussion is provided, such as citations from the SWRCB Order, a map showing the relevant section of the river, or cross-section of the river and shallow alluvium have been permitted, licensed and managed as "underflow" by the SWRCB. According to California's Electronic Water Rights Information Management System (eWRIMS), there appear to be only a handful of water rights permits (5 active and 1 inactive) that fall under "underflow" within the CMA (Figure 1). While few water rights in the CMA may have "underflow" permits or licenses, the GSP has failed to substantiate the assertion that the shallow aquifer - **in its entirety** - is classified and managed as "underflow" by the SWRCB. We are generally concerned that the GSP is grossly extrapolating the existence of "underflow" in the shallow alluvium across the entire basin from a limited number of "underflow" points of diversions within the basin that are actually being managed by SWRCB. If the SWRCB is not managing the entire shallow aquifer as "underflow" and the beneficial users of groundwater and surface water reliant on it - this water is actually groundwater and is instead subject to SGMA regulations.

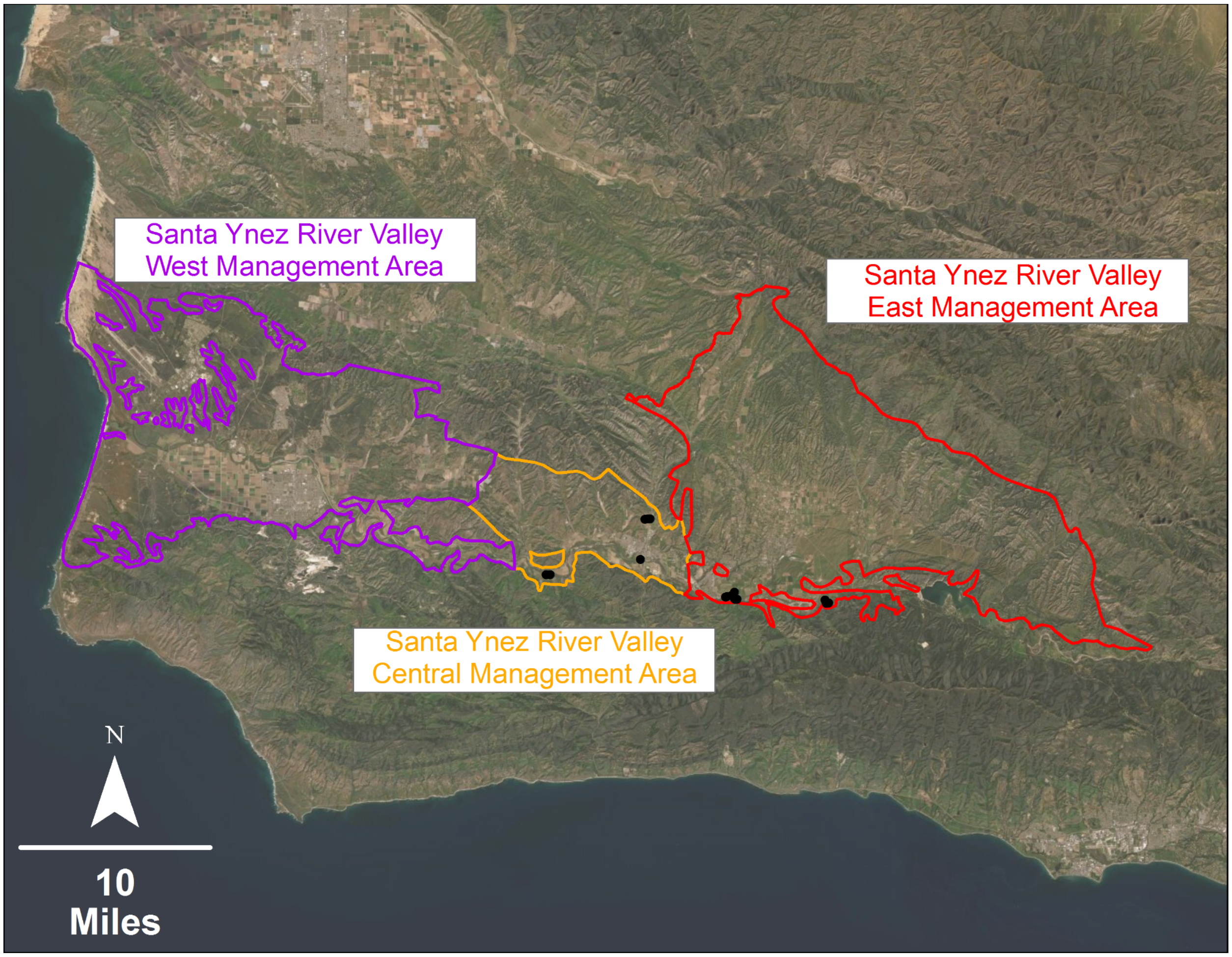

Figure 1. Points of Diversion (black circles) classified as "Santa Ynez River Underflow" within the CMA (orange) and Eastern Management Area (EMA; red). No "underflow" points of diversion were located in the Western Management Area (WMA; purple). Data Source: eWRIMS.

The GSP continues (p. 2b-35): *"All tributaries within the CMA (Figure 2b.6-1) are ephemeral. As shown on Figure 2b.6-2, Zaca Creek, the largest CMA tributary, has no measurable flow during half of the period of record. Most flow occurs in wet and above normal years between February to March, with no flow between June to November. This indicates these tributaries are "completely depleted" during part of the year and do not meet the SGMA definition for interconnected surface water."* The last sentence of this section illustrates a misunderstanding of the SGMA definition of ISW. Note the regulations [23 CCR §351(o)], which are cited in several places in the GSP, define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". The GSP focuses on the phrase "completely depleted," without acknowledging the phrase "at any point." "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs.

The ISW section of the GSP does not provide a map or concluding statement regarding which reaches in the CMA are considered interconnected or disconnected. In Section 3b.2-6 (Interconnected Surface and Groundwater – Undesirable Results), the GSP states (p. 3b-22): *"The Santa Ynez River is the predominant interconnected surface water and groundwater system* *in the CMA and extends from the EMA to the WMA (Figure 3b.2-3)."* This figure is missing from the GSP, however.

RECOMMENDATIONS
• Provide a map showing all the stream reaches in the CMA, with reaches clearly labeled as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP. • Substantiate the assertion that the shallow aquifer - **in its entirety** - is classified and managed as "underflow" by the SWRCB. For example, include a map and description of whether "underflow" points of diversion and "groundwater" extraction wells are both extracting from the same shallow alluvium. Discuss SWRCB Order WR 2019-0148 and explain how it relates to the definition of ISW in the CMA. Cite relevant sections of the order, maps, and cross-sections. • Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. • Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015. • Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, we found that some mapped features in the NC dataset were improperly disregarded, as described below.

- NC dataset polygons were incorrectly removed If depth to groundwater has historically exceeded the 30-foot depth identified by the Nature Conservancy as representative of groundwater conditions that may sustain common phreatophytes and wetland ecosystems. However, description of the groundwater data used for the 30-foot threshold analysis is not provided in the GSP text. If it is the fall 2019 and spring 2020 data described in Section 2b.1-2 (Groundwater Elevation Contour Maps), then this data does not provide sufficient seasonal and temporal variability and it is after the 2015 SGMA benchmark date.
- NC dataset polygons were incorrectly removed from riparian areas of the Santa Ynez River if identified as being "underflow" and managed by the SWRCB. However, as stated

above under the ISW section of this letter, the GSP has failed to substantiate the assertion that the shallow aquifer - **in its entirety** - is classified and managed as "underflow" by the SWRCB, nor has the GSP provided a sufficient explanation of how the SWRCB Order relates to groundwater management in the CMA.

Table 2a.4-4 lists threatened and endangered species in the CMA, but the GSP does not present a complete inventory of flora and fauna species present in the CMA's GDEs.

RECOMMENDATIONS
● Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a pre-SGMA baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. ● Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as valley oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources. ● Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape. ● If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network. ● Include an inventory of the flora and fauna present within the CMA's GDEs (see Attachment C of this letter for a list of freshwater species located in the CMA). ● Show the extent of the shallow aquifer that is classified and managed as "underflow" by the SWRCB. For example, include a map and description of extraction points and whether they source "underflow" or "groundwater" from the shallow alluvium. Discuss SWRCB Order WR 2019-0148 and explain how it relates to SGMA and the definition of ISW in the CMA. Cite relevant sections of the order, maps, and cross-sections.

Native Vegetation and Managed Wetlands
Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[3,4] The integration of native vegetation into the water budget is **sufficient**. We commend the GSA for including the groundwater demands of this ecosystem in the historical, current and projected water budgets. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the CMA.

RECOMMENDATION
• State whether or not there are managed wetlands in the CMA. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development
Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Public Outreach and Engagement Plan (Appendix 1c-C).[5]

We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms and include attending GSA meetings and workshops, reading electronic newsletters, providing input on the draft and final GSP, and a Citizen Advisory Group. There are no specific details provided regarding targeted outreach to DACs, domestic well owners, and environmental stakeholders.

- The Public Outreach and Engagement Plan does not include specific plans for continual engagement during the GSP *implementation* phase with DACs, domestic well owners, and environmental stakeholders.

RECOMMENDATION
• Include a more detailed and robust Public Outreach and Engagement Plan that describes active and targeted outreach to engage DAC members, domestic well owners, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

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[3] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]
[4] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]
[5] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- Utilize DWR's tribal engagement guidance to comprehensively address all tribal beneficial users in the basin within the GSP.[6]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[7,8,9]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP presents a well impact analysis to assess the potential impacts of water level decline on domestic wells (Appendix 3b-B), which was used to determine the groundwater level minimum thresholds for the CMA. The GSP states (p. 3b-26): *"The minimum threshold for chronic lowering of groundwater levels in the Buellton Upland Aquifer was chosen by the CMA GSA to be 15 feet below 2020 groundwater levels in half of the RMWs for a period of two consecutive non-drought years. 15 feet below 2020 groundwater elevations is the level at which 30 percent of domestic and municipal wells would begin to entrain air into the screens and is established with consideration of operational flexibility and beneficial use types within the basin (Appendix 3b-B). About 10 percent of agricultural wells would be impacted at this level."* Despite this well impact analysis, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users in those 30% domestic wells predicted to be affected, especially given the absence of a well mitigation plan in the GSP.

In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs when defining undesirable results, nor does it describe how the groundwater level minimum thresholds will avoid significant and unreasonable impacts to DACs and domestic well users beyond 2015 and be consistent with Human Right to Water policy.[10]

For degraded water quality, the GSP identifies the constituents of concern (COCs) in the CMA as the following: boron, chloride, total dissolved solids (TDS), sulfate, sodium, and nitrate. The minimum threshold for nitrate is set to the maximum contaminant level (MCL) of 10 mg/L for nitrate as nitrogen. The minimum threshold for TDS is set to the secondary maximum contaminant level (SMCL) of 1,000 mg/L. For the other COCs, the minimum threshold concentrations are established at the median Water Quality Objectives (WQOs) established from the Central Coastal Basin Water Quality Control Plan (CCBWQCP). The GSP does not compare the WQOs with MCLs to ensure the most protective values are chosen as minimum thresholds.

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[6] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[7] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[8] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[9] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[10] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

The GSP only includes a very general discussion of impacts to drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users and DACs when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

Degraded Water Quality

- Describe direct and indirect impacts on DACS and drinking water users when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[11]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACS and drinking water users.

- Provide a table in the GSP that compares WQOs to MCLs for all COCs. Ensure that the most protective value is chosen for the minimum threshold.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP only considers GDEs with respect to the depletion of interconnected surface water sustainability indicator, but not the chronic lowering of groundwater levels sustainability indicator. No analysis or discussion is provided in the GSP that describes impacts on GDEs or establishes SMC for GDEs that are directly dependent on groundwater. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise these environmental beneficial users. Since GDEs may be present in areas of the CMA that are not adjacent to ISW (see our comments in the GDE section of this letter), they must be considered when developing SMC for chronic lowering of groundwater levels.

For depletions of interconnected surface water, the GSP does not describe undesirable results to beneficial users of surface water, other than to say (p. 3b-23): *"Surface water releases through the Cachuma Reservoir to the CMA are managed by SWRCB under Order WR 2019-0148. The lowering of groundwater levels below historical lows in the Upper Aquifer potentially impacts habitat and ecosystem health along the Santa Ynez River."*

The GSP continues (p. 3b-24): *"Using groundwater levels adjacent to the Santa Ynez River, undesirable results associated with a depletion of interconnected surface water and groundwater will be quantified by measuring groundwater elevations semi-annually at three representative monitoring points located adjacent to the Santa Ynez River (Figure 3b.2-3) and maintaining water levels above historical low groundwater levels. Significant and undesirable results are defined as groundwater elevations that drop to 15 feet below channel thalweg elevations in two out of the*

[11] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

three representative monitoring wells for two consecutive non-drought years (Section 3b.3-6)." However, no analysis or discussion is presented to describe how the SMC will affect GDEs, or the impact of these minimum thresholds on GDEs in the CMA. Furthermore, the GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the CMA, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- Define chronic lowering of groundwater SMC directly for environmental beneficial users of groundwater. When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact on GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the CMA.[12] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[13]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the CMA are reached.[14] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,15]

- When establishing SMC for the basin, please consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

[12] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[13] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[14] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[15] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[16] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[17] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the CMA. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

The GSP incorporates climate change into key inputs (e.g., precipitation and evapotranspiration) of the projected water budget. However, imported water should be adjusted for climate change and clearly incorporated into the surface water flow inputs of the projected water budget. Furthermore, the GSP does not provide a sustainable yield based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of projected climate change effects on surface water flow inputs, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS
• Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions. • Incorporate climate change into surface water flow inputs, including imported water, for the projected water budget. • Estimate sustainable yield based on the projected water budget with climate change incorporated. • Incorporate climate change scenarios into projects and management actions.

[16] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[17] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Wells (RMWs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs in the CMA.

Figure 3a.3-1 (CMA Monitoring Network and Representative Monitoring Wells for Groundwater Levels and Groundwater Storage) shows insufficient representation of DACs for groundwater elevation monitoring. Figure 3a.3-2 (CMA Monitoring Network and Representative Monitoring Wells for Water Quality) shows insufficient representation of DACs for water quality monitoring. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[18]

Figure 3a.3-3 (CMA Monitoring Network and Representative Monitoring for Groundwater Dependent Ecosystems) shows RMWs along the length of the Santa Ynez River that adequately cover the area of mapped GDEs. The figure denotes a data gap area near potential GDEs where a piezometric well is proposed.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, GDEs, and ISWs to clearly identify which beneficial users are not adequately being monitored spatially and at depth.
- Increase the number of RMWs in the shallow aquifer across the CMA as needed to adequately monitor all groundwater condition indicators across the CMA and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMWs.
- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the CMA.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

The GSP lists a PMA entitled "Drought Mitigation by Pumping Optimization and Deepen Existing Wells" (p. 4a-35), but the GSP states that it is not a current commitment that the GSA plans to implement. We strongly recommend including specific plans to implement a drinking water well impact mitigation program

[18] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

since the SMC section of the GSP outlines that a significant percentage of domestic wells will be impacted at minimum thresholds.

RECOMMENDATIONS

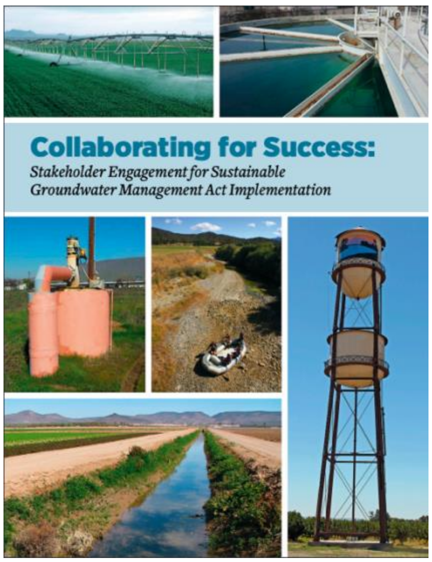
- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.
- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.
- The GSP discusses Project Management Action No. 4: Increase Stormwater Recharge. Note that recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For further guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[19]
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[19] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

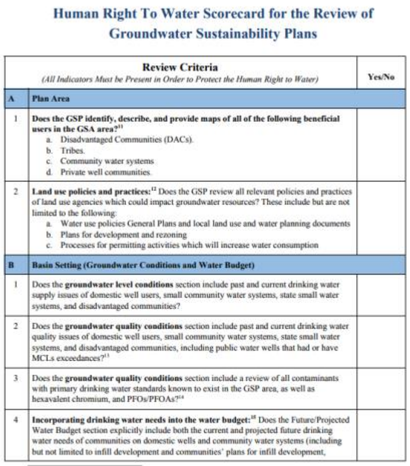
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

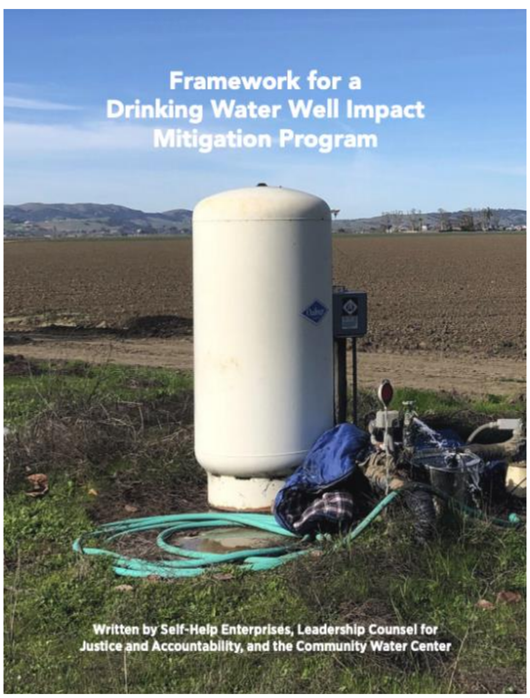


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

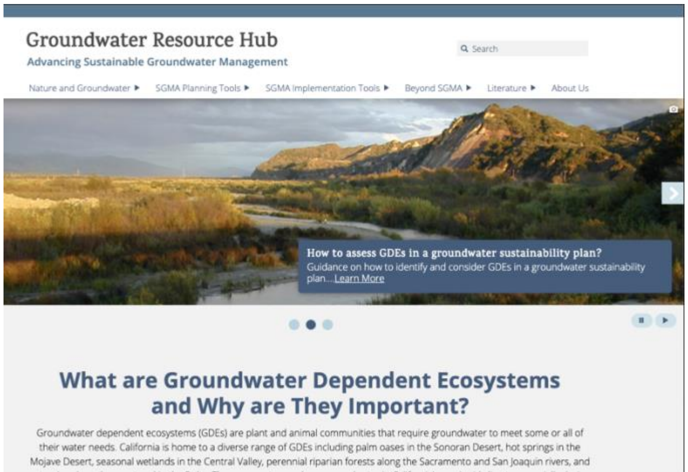
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



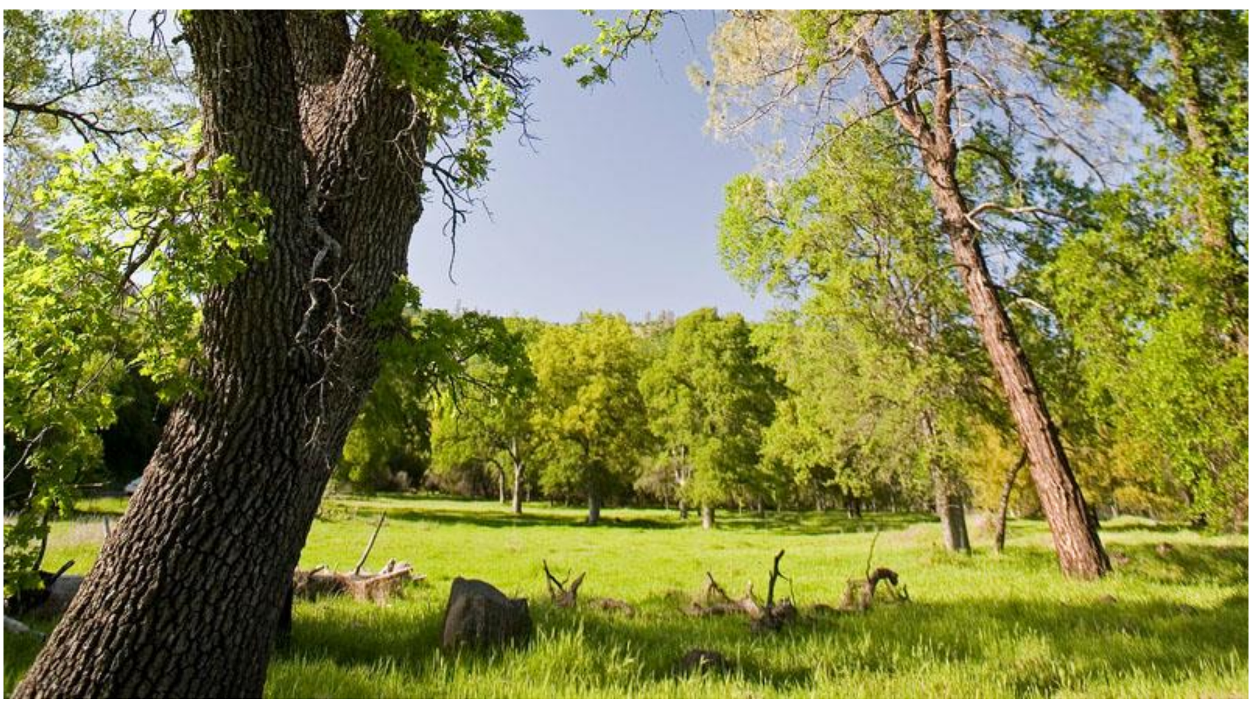
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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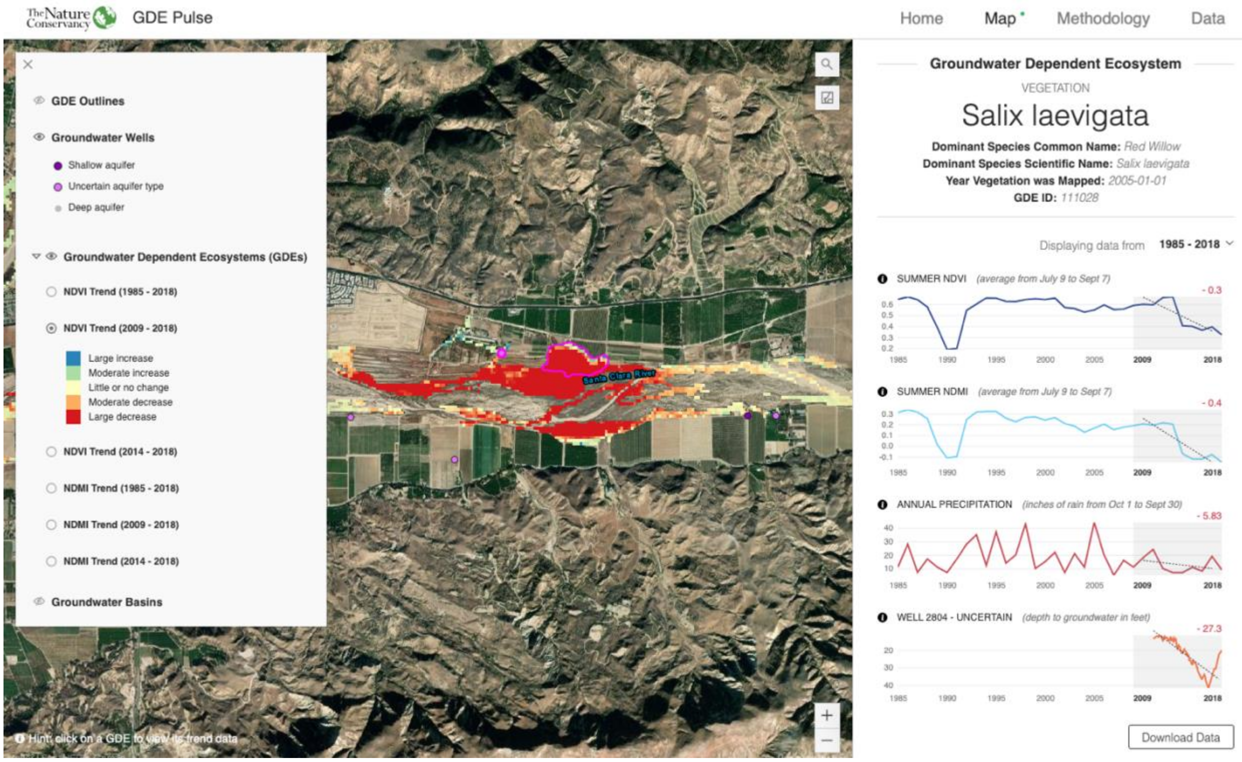
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

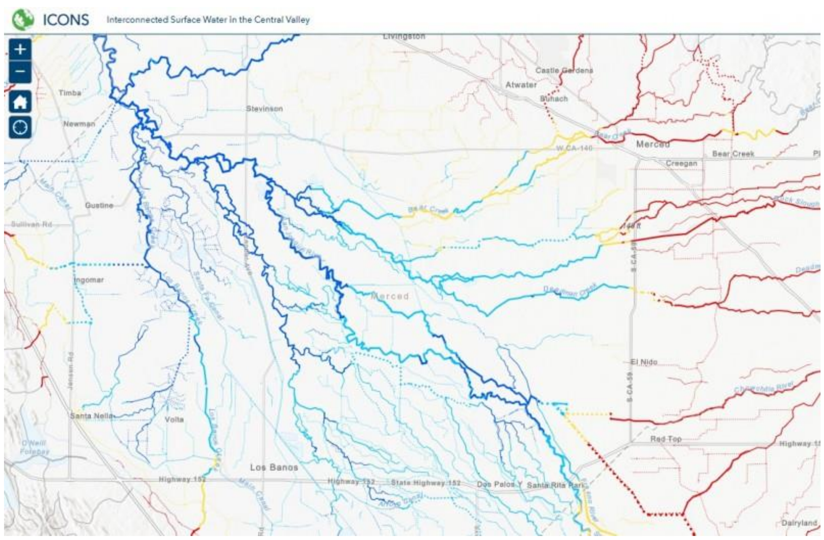
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Santa Ynez River Valley Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Santa Ynez River Valley Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gelochelidon nilotica vanrossemi	Gull-billed Tern	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Laterallus jamaicensis coturniculus	California Black Rail	Bird of Conservation Concern	Threatened	
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			

Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oreothlypis luciae	Lucy's Warbler		Special Concern	BSSC - Third priority
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Rynchops niger	Black Skimmer			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Americorophium spinicorne				Not on any status lists
Cyprididae fam.	Cyprididae fam.			
Gammarus spp.	Gammarus spp.			
Hyalella spp.	Hyalella spp.			
Neomysis mercedis				Not on any status lists
Ramellogammarus spp.	Ramellogammarus spp.			
FISH				
Eucyclogobius newberryi	Tidewater goby	Endangered	Special Concern	Vulnerable - Moyle 2013
Gasterosteus aculeatus williamsoni	Unarmored threespine stickleback	Endangered	Endangered	Endangered - Moyle 2013

Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus mykiss - Southern CA	Southern California steelhead	Endangered	Special Concern	Endangered - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Pseudacris cadaverina	California Treefrog			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Anaxyrus boreas halophilus	California Toad			ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
Thamnophis atratus atratus	Santa Cruz Gartersnake			Not on any status lists
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis elegans terrestris	Coast Gartersnake			Not on any status lists
Thamnophis sirtalis infernalis	California Red-sided Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Acentrella spp.	Acentrella spp.			
Acilius abbreviatus				Not on any status lists
Agabinus glabrellus				Not on any status lists
Agabus disintegratus				Not on any status lists
Agabus lutosus				Not on any status lists
Agabus spp.	Agabus spp.			
Agapetus spp.	Agapetus spp.			

Ambrysus spp.	Ambrysus spp.			
Anacaena signaticollis				Not on any status lists
Anax junius	Common Green Darner			
Anax spp.	Anax spp.			
Anisitsiellidae fam.	Anisitsiellidae fam.			
Apedilum spp.	Apedilum spp.			
Archilestes grandis	Great Spreadwing			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetidae fam.	Baetidae fam.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Belostomatidae fam.	Belostomatidae fam.			
Berosus infuscatus				Not on any status lists
Berosus punctatissimus				Not on any status lists
Caenis bajaensis	A Mayfly			
Caenis spp.	Caenis spp.			
Callibaetis spp.	Callibaetis spp.			
Caudatella spp.	Caudatella spp.			
Centroptilum spp.	Centroptilum spp.			
Chaetarthria magna				Not on any status lists
Chaetarthria punctulata				Not on any status lists
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus anonymus				Not on any status lists
Chironomus spp.	Chironomus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Colymbetes strigatus				Not on any status lists
Copelatus glyphicus				Not on any status lists
Cordulegaster dorsalis	Pacific Spiketail			
Corisella spp.	Corisella spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus annulator				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cybister ellipticus				Not on any status lists
Cymbiodyta columbiana				Not on any status lists

Cymbiodyta dorsalis				Not on any status lists
Cymbiodyta pacifica				Not on any status lists
Dicrotendipes adnilus				Not on any status lists
Dicrotendipes spp.	Dicrotendipes spp.			
Dytiscidae fam.	Dytiscidae fam.			
Dytiscus marginicollis				Not on any status lists
Enallagma cyathigerum				Not on any status lists
Enallagma praevarum	Arroyo Bluet			
Enallagma spp.	Enallagma spp.			
Enochrus californicus				Not on any status lists
Enochrus carinatus				Not on any status lists
Enochrus cristatus				Not on any status lists
Enochrus cuspidatus				Not on any status lists
Enochrus piceus				Not on any status lists
Enochrus pygmaeus				Not on any status lists
Ephydridae fam.	Ephydridae fam.			
Eubrianax edwardsii				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Helichus spp.	Helichus spp.			
Helichus suturalis				Not on any status lists
Hetaerina americana	American Rubyspot			
Heterocerus mexicanus				Not on any status lists
Hydrobius fuscipes				Not on any status lists
Hydrophilidae fam.	Hydrophilidae fam.			
Hydrophilus triangularis				Not on any status lists
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ischnura perparva	Western Forktail			
Labrundinia spp.	Labrundinia spp.			
Laccobius spp.	Laccobius spp.			

Laccophilus maculosus				Not on any status lists
Lauterborniella spp.	Lauterborniella spp.			
Libellula saturata	Flame Skimmer			
Limnophyes asquamatus				Not on any status lists
Limnophyes spp.	Limnophyes spp.			
Liodessus obscurellus				Not on any status lists
Microcylloepus spp.	Microcylloepus spp.			
Micropsectra nigripila				Not on any status lists
Micropsectra spp.	Micropsectra spp.			
Nectopsyche spp.	Nectopsyche spp.			
Neoclypeodytes pictodes				Not on any status lists
Neoclypeodytes plicipennis				Not on any status lists
Ochthebius apache				Not on any status lists
Ochthebius discretus				Not on any status lists
Ochthebius puncticollis				Not on any status lists
Ochthebius spp.	Ochthebius spp.			
Optioservus spp.	Optioservus spp.			
Orthocladius appersoni				Not on any status lists
Orthocladius spp.	Orthocladius spp.			
Oxyethira spp.	Oxyethira spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Peltodytes callosus				Not on any status lists
Peltodytes spp.	Peltodytes spp.			
Pentaneura spp.	Pentaneura spp.			
Plathemis lydia	Common Whitetail			
Procloeon venosum	A Mayfly			
Pseudochironomus spp.	Pseudochironomus spp.			
Pseudosmittia forcipata				Not on any status lists
Pseudosmittia spp.	Pseudosmittia spp.			
Psychodidae fam.	Psychodidae fam.			
Rhantus anisonychus				Not on any status lists
Rhantus gutticollis				Not on any status lists

Rhantus wallisi				Not on any status lists
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Serratella micheneri	A Mayfly			
Sigara spp.	Sigara spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sperchontidae fam.	Sperchontidae fam.			
Stictotarsus griseostriatus				Not on any status lists
Stictotarsus spp.	Stictotarsus spp.			
Stictotarsus striatellus				Not on any status lists
Sympetrum illotum	Cardinal Meadowhawk			
Tanytarsus spp.	Tanytarsus spp.			
Tramea lacerata	Black Saddlebags			
Trichocorixa arizonensis				Not on any status lists
Trichocorixa spp.	Trichocorixa spp.			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus californicus				Not on any status lists
Tropisternus spp.	Tropisternus spp.			
Uvarus subtilis				Not on any status lists
Zaitzevia parvula				Not on any status lists
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
MOLLUSKS				
Gyraulus vermicularis	Pacific Coast Gyraulus			CS
Physa acuta	Pewter Physa			Not on any status lists
Physa spp.	Physa spp.			
Physella virgata	Protean Physa			CS
Planorbella trivolvis	Marsh Rams-horn			CS
Planorbidae fam.	Planorbidae fam.			
Sphaerium occidentale				Not on any status lists
Sphaerium spp.	Sphaerium spp.			
Vorticifex spp.	Vorticifex spp.			
PLANTS				
Lasthenia glabrata coulteri	Coulter's Goldfields		Special	CRPR - 1B.1
Alnus rhombifolia	White Alder			

Alopecurus carolinianus	Tufted Foxtail			
Alopecurus saccatus	Pacific Foxtail			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla filiculoides	NA			
Baccharis glutinosa	NA			Not on any status lists
Berula erecta	Wild Parsnip			
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Callitriche marginata	Winged Water-starwort			
Carex harfordii	Harford's Sedge			
Carex pellita	Woolly Sedge			
Carex senta	Western Rough Sedge			
Ceratophyllum demersum	Common Hornwort			
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Downingia cuspidata	Toothed Calicoflower			
Elatine brachysperma	Shortseed Waterwort			
Elatine californica	California Waterwort			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Eleocharis parishii	Parish's Spikerush			
Epilobium campestre	NA			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Helenium puberulum	Rosilla			
Hypericum anagalloides	Tinker's-penny			
Isoetes howellii	NA			
Isolepis cernua	Low Bulrush			
Jaumea carnosa	Fleshy Jaumea			
Juncus effusus effusus	NA			
Juncus falcatus falcatus	Sickle-leaf Rush			
Juncus phaeocephalus phaeocephalus	Brown-head Rush			
Juncus textilis	Basket Rush			

Juncus xiphioides	Iris-leaf Rush			
Lemna minuta	Least Duckweed			
Mimulus guttatus	Common Large Monkeyflower			
Muhlenbergia utilis	Aparejo Grass			
Nasturtium gambelii	NA	Endangered	Threatened	CRPR - 1B.1
Oenanthe sarmentosa	Water-parsley			
Persicaria lapathifolia				Not on any status lists
Phacelia distans	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys undulatus	NA			Not on any status lists
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Populus trichocarpa	NA			Not on any status lists
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus tenellus	NA			
Rumex conglomeratus	NA			
Rumex fueginus				Not on any status lists
Rumex salicifolius salicifolius	Willow Dock			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Samolus parviflorus	NA			Not on any status lists
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus californicus	California Bulrush			
Schoenoplectus pungens pungens	NA			
Scirpus microcarpus	Small-fruit Bulrush			
Sinapis alba	NA			
Sparganium eurycarpum eurycarpum				
Stachys chamissonis chamissonis	Coast Hedge-nettle			
Stachys pycnantha	Short-spike Hedge-nettle			

Stuckenia pectinata				Not on any status lists
Triglochin scilloides	NA			Not on any status lists
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	NA			
Veronica peregrina	NA			
Wolffiella lingulata	Tongue Bogmat			
Zannichellia palustris	Horned Pondweed			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

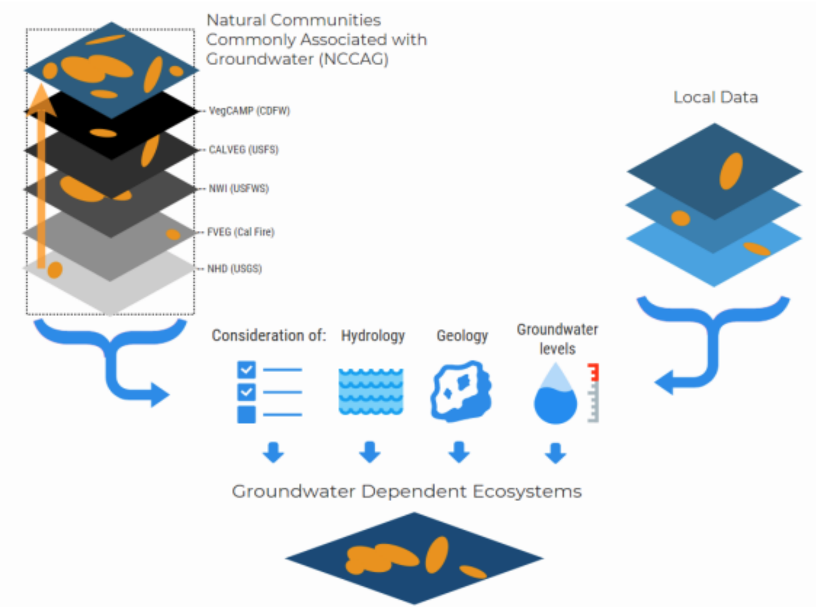


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

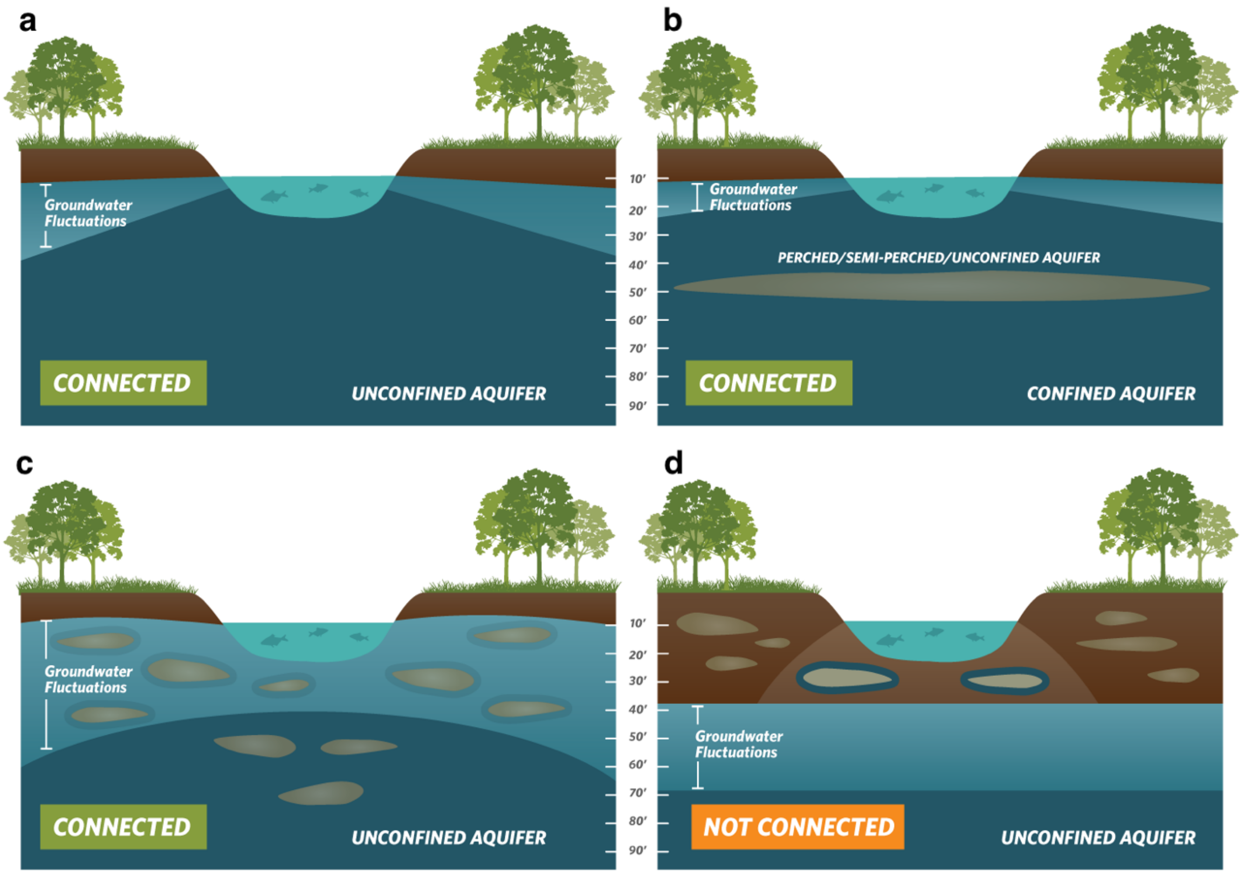

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

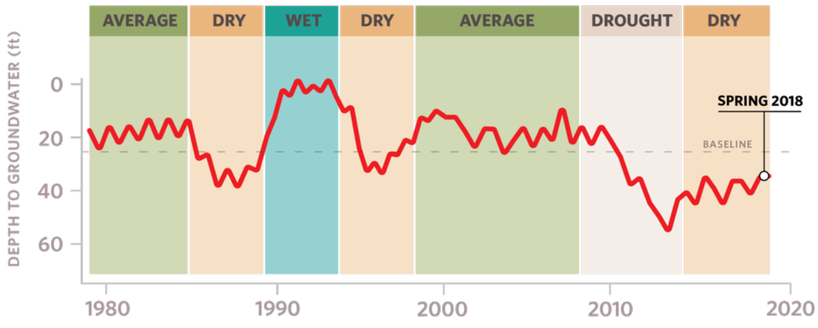

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

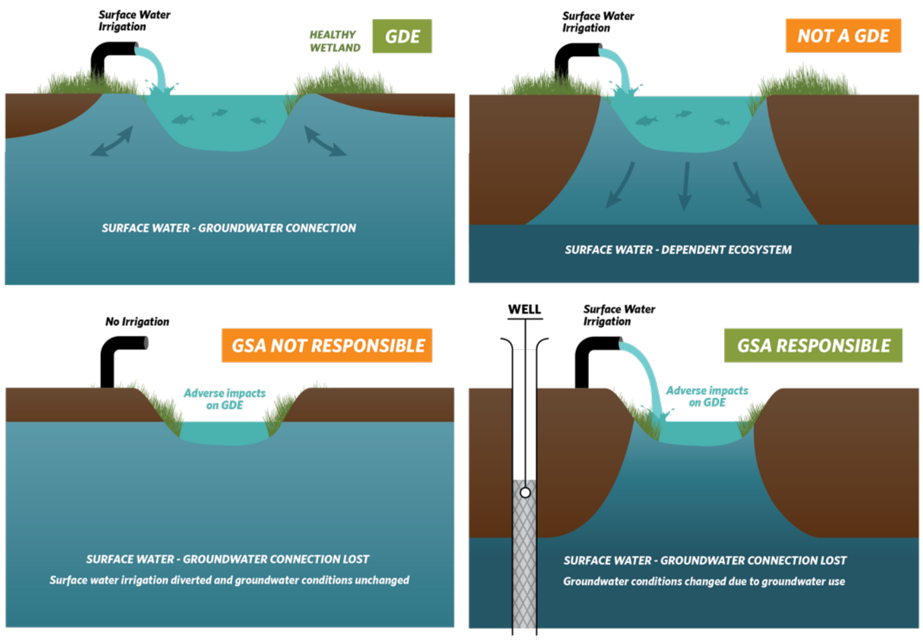

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

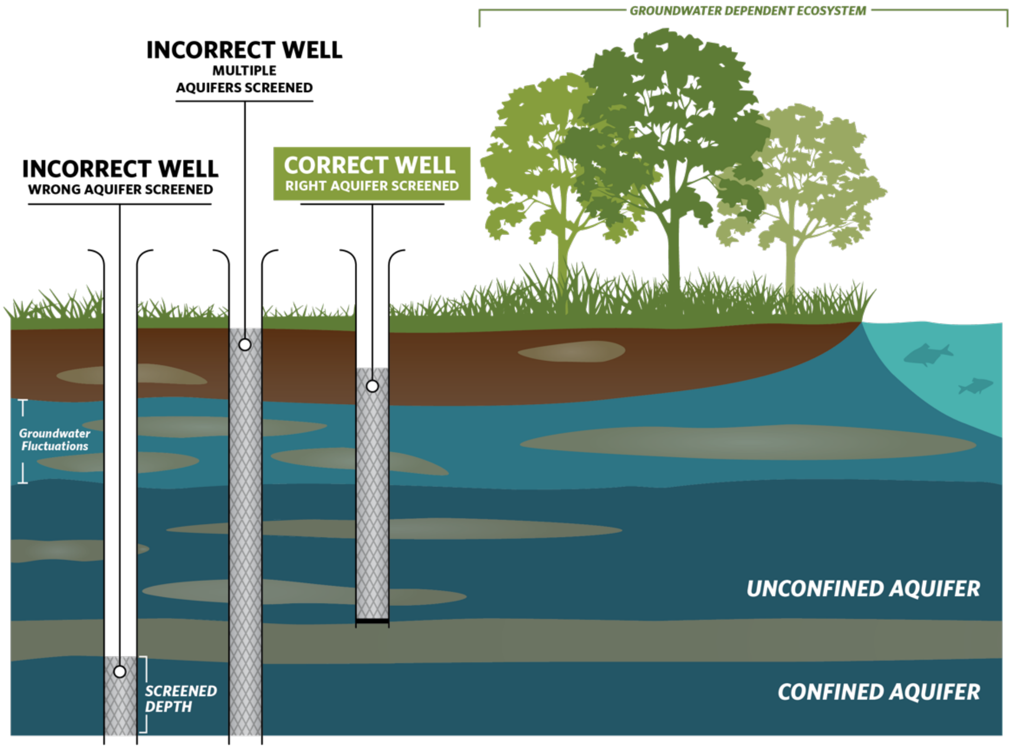

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

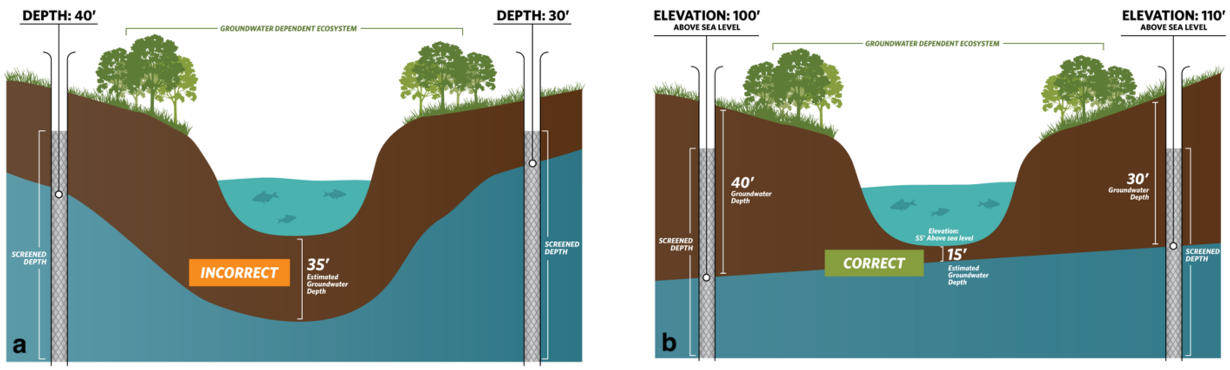

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

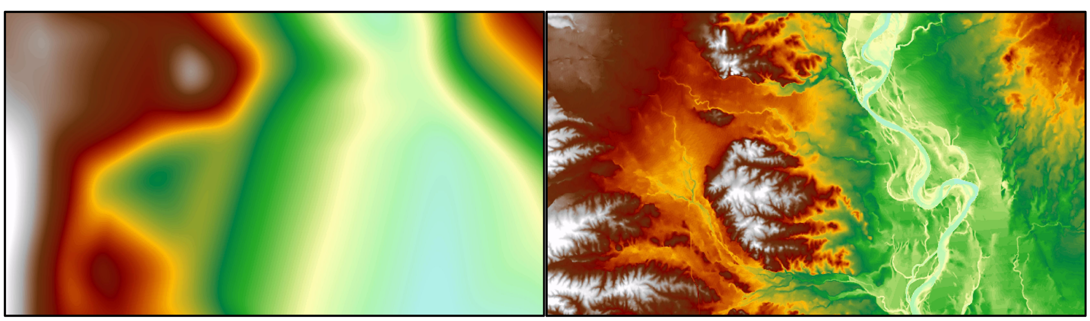

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

October 24, 2021

Santa Ynez River Valley Basin Eastern Management Area GSA
P.O. BOX 719,
Santa Ynez, CA 93460

Submitted via web: https://portal.santaynezwater.org/comment/new?gsaKey=EMA

Re: Public Comment Letter for Santa Ynez River Valley Basin Eastern Management Area Draft GSP

Dear Bill Buelow,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Santa Ynez River Valley Basin Eastern Management Area being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.

2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Santa Ynez River Valley Basin Eastern Management Area Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Santa Ynez River Valley Basin
Eastern Management Area (EMA) Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes
The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **incomplete**.

The GSP describes and maps tribal lands in the Eastern Management Area (EMA) in Figure 2-2. The GSP also identifies and maps the location of each DAC within the EMA. However, the plan fails to clearly document the population of each DAC. Additionally, Figure 2-7 provides a map of communities within the EMA served by groundwater, but does not specifically provide the drinking water source for DACs.

While the plan provides a density map of domestic wells in the EMA, the GSP fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range).

These missing elements are required for the GSA to fully understand the specific water demands of beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS

- Provide the population of each identified DAC. Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

- Include a map showing domestic well locations and average well depth across the EMA.

---

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

Interconnected Surface Waters
The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP presents a conceptual representation of gaining, losing, and disconnected streams (Figure 3-34. Gaining and Losing Streams). The GSP presents a map (Figure 3-35. Stream Classifications) of the EMA's stream reaches, as classified by the USGS National Hydrography Dataset (NHD), with labels 'Perennial' and `Intermittent'. The relationship of these terms, however, are not discussed in relation to the gaining, losing, and disconnected terms presented in the prior figure. If the GSP is making the unstated assumption that perennial reaches are equivalent to interconnected reaches, this is an incorrect conclusion. Note the regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs. The GSP does not present or analyze depth to groundwater data when identifying ISWs in the EMA.

RECOMMENDATIONS

- Provide a map showing all the stream reaches in the EMA, with reaches clearly labeled as interconnected or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.

- Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.

- Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems
The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, we found that some mapped features in the NC dataset were improperly disregarded, as described below.

- NC dataset polygons were incorrectly removed based on the assumption that they are supported by the shallow, perched water table. However, shallow aquifers that have the potential to support well development, support ecosystems, or provide baseflow to streams are principal aquifers, even if the majority of the EMA's pumping is occurring in deeper principal aquifers.[2] If there are no data to characterize groundwater conditions in the shallow principal aquifer, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP.

- NC dataset polygons were incorrectly removed from riparian areas of the Santa Ynez River that are considered to be managed by SWRCB as part of Santa Ynez River surface and underflow, and are not considered connected to "groundwater" under SGMA. The GSP has provided no map or details on the physical extent of the basin and wells that have been permitted, licensed and managed as underflow by the SWRCB. According to California's Electronic Water Rights Information Management System (eWRIMS), there appear to be only a handful of water rights permits (2 active and 7 inactive) that fall under "underflow" within the EMA (Figure 1). While a few water rights in the EMA may have "underflow" permits or licenses, the GSP has failed to substantiate the assertion that the shallow aquifer - in its entirety - is classified and managed as "underflow" by the SWRCB. We are generally concerned that the GSP is grossly extrapolating the existence of "underflow" in the shallow alluvium across the entire basin from a limited number of "underflow" points of diversions within the basin that are actually being managed by SWRCB. If the SWRCB is not managing the entire shallow aquifer as "underflow" and the beneficial users of groundwater and surface water reliant on it - this water is actually groundwater and is instead subject to SGMA regulations.

[2] "'Principal aquifers' refer to aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems." [23 CCR §351(aa)]

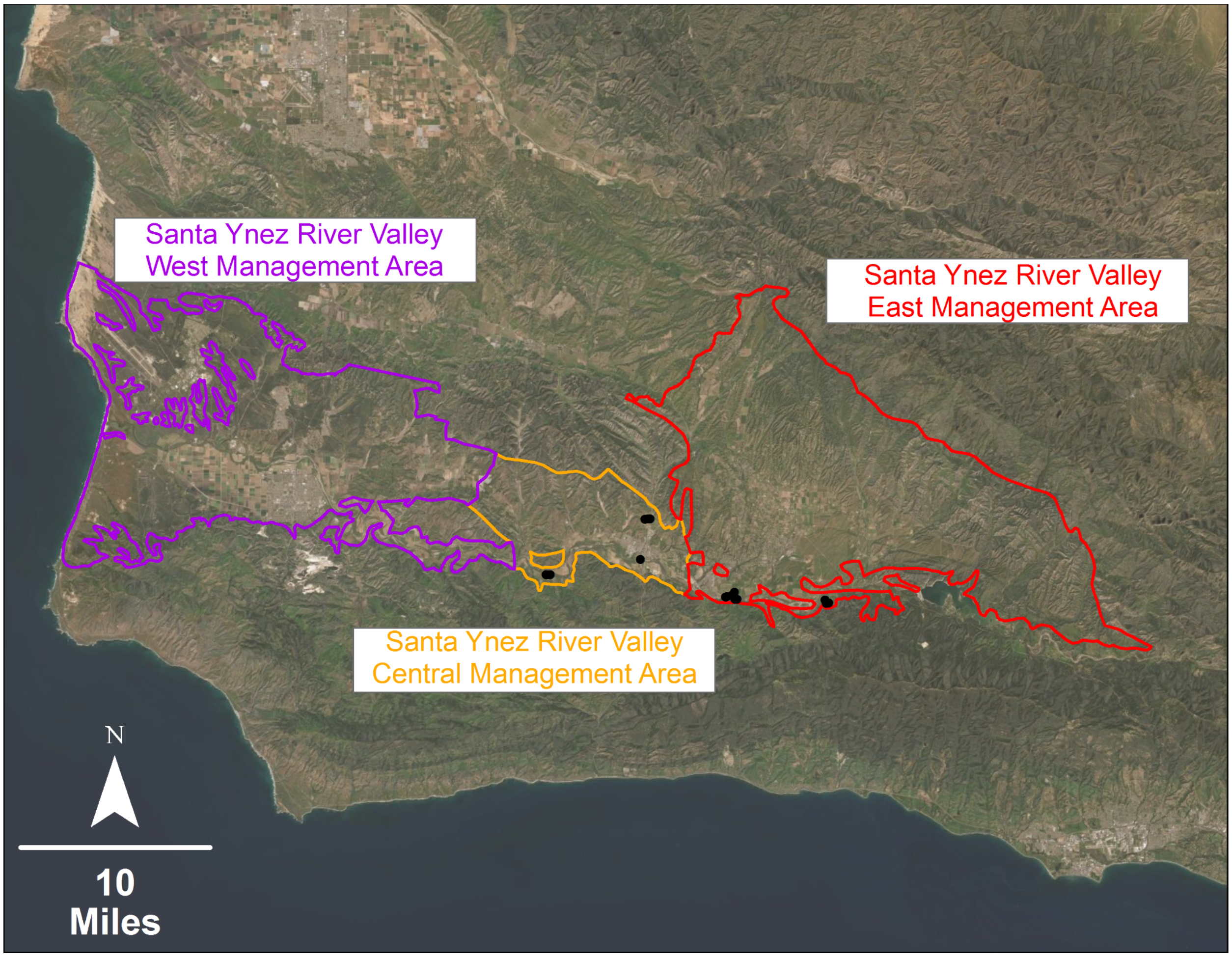

Figure 1. Points of Diversion (black circles) classified as "Santa Ynez River Underflow" within the EMA (red) and Central Management Area (CMA; orange). No "underflow" points of diversion were located in the Western Management Area (WMA; purple). Data Source: eWRIMS.

The GSP states (3-90): "*Contoured groundwater elevation data for spring 2015 was used to determine areas where the Natural Communities polygons were within 30 feet depth to groundwater. Spring 2015 groundwater elevations were chosen for this analysis because this marked a period of the greatest recent data availability. These data are considered representative of average spring-summer conditions within the last 5 years.*" We recommend using groundwater data from multiple seasons and water year types to determine the range of depth to groundwater around NC dataset polygons.

We commend the GSA for including an inventory of flora and fauna species in the EMA's GDEs. Section 3.2.6.1.1 presents a discussion of potential GDE vegetation classifications, and each of these GDE units is mapped individually on Figure 3-36 (Natural Communities Commonly Associated with Groundwater Dataset). Table 3-14 presents the special-status species within the EMA. Within Section 3.2.6.1.1 (Potential GDE Vegetation Classifications), the GSP states that the maximum rooting depth of valley oak (*Quercus lobata*) is 80 feet. However, this deeper rooting depth was not used when verifying whether valley oak polygons from the NC Dataset are supported by groundwater.

RECOMMENDATIONS

- Show the extent of the shallow aquifer that is classified and managed as "underflow" by the SWRCB. For example, include a map and description of extraction points and whether they source "underflow" or "groundwater" from the shallow alluvium. Discuss SWRCB Order WR 2019-0148 and explain how it relates to SGMA and the definition of ISW in the EMA. Cite relevant sections of the order, maps, and cross-sections.

- Re-evaluate the EMA's GDEs noting the incorrect removal criteria listed above. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape.

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a pre-SGMA baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as valley oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[3,4] The integration of native vegetation into the water budget is **sufficient**. We commend the GSA for including the groundwater demands of this ecosystem in the historical, current and projected water budgets. The GSP states on p. 2-15 that there are no managed wetlands in the EMA.

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[3] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[4] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Communication and Engagement Plan (Appendix J).[5]

The Communication and Engagement Plan describes outreach to the Santa Ynez Band of Chumash Indians. A representative of the Chumash Tribe is a member of the EMA Citizens Advisory Group (CAG). However, we note the following deficiencies with the overall stakeholder engagement process:

- Although the Communication and Engagement Plan describes efforts to conduct outreach to DACs during GSP development, including the use of culturally appropriate language, education about the SGMA process, and quarterly newsletters in English and Spanish, there is no active participation of DACs within the EMA CAG.

- Public involvement and engagement with environmental stakeholders are described in very general terms. Aside from allowing environmental organizations involvement in the SGMA process regarding environmental uses of groundwater and invitations to apply to participate on the Citizens Advisory Group, there are no specific details of outreach to environmental communities.

- The Communication and Engagement Plan does not include specific, targeted outreach and engagement opportunities to DACs, tribal stakeholders, and environmental stakeholders during the GSP *implementation* phase.

RECOMMENDATION
• In the Communication and Engagement Plan, describe active and targeted outreach to engage all stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. • Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the basin within the GSP.[6]

[5] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

[6] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[7,8,9]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP presents a well impact analysis to assess the potential impacts of water level decline on domestic wells screened in the Paso Robles Formation and Careaga Sand. The GSP states (p. 5-20): *"Based on the well impact analysis, the GSA Committee agreed to set the minimum threshold for representative wells screened in the Paso Robles Formation at 15 feet below spring 2018 groundwater levels."* At this groundwater elevation, 33% of domestic wells are predicted to have water levels fall below the top of the screen. The GSP states (p. 5-20): *"Based on the well impact analysis, the GSA Committee agreed to set the minimum threshold for representative wells screened in the Careaga Sand at 12 feet below spring 2018 groundwater levels."* At this groundwater elevation, 39% of domestic wells are predicted to have water levels fall below the top of the screen. Despite this well impact analysis, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water, especially given the absence of a well mitigation plan in the GSP.

In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs or tribes when defining undesirable results, nor does it describe how the existing groundwater level minimum thresholds will avoid significant and unreasonable impacts to DACs and domestic well users beyond 2015 and be consistent with Human Right to Water policy.[10]

For degraded water quality, the GSP presents water quality standards for constituents of concern (COCs) in Table 5-3. The GSP establishes minimum thresholds pertaining to salts and nutrients as follows (p. 5-41): *"Concentrations of TDS, chloride, sulfate, boron, sodium, and nitrate are equal to or greater than WQOs in 50 percent of representative wells or are equal to concentrations present when SGMA was enacted (January 2015). The WQOs [Water Quality Objectives] for each constituent are presented in Table 5-3 are considered the minimum thresholds for salts and nutrients. In cases where the ambient (prior to January 2015) water quality exceeds the WQO, the ambient water quality is considered the minimum threshold."* The GSP does not state which COCs this applies to or present the ambient concentrations, however. The GSP should include SMC for all COCs in the EMA that may be impacted by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

The GSP only includes a very general discussion of impacts to drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs, drinking water users, or tribes when defining undesirable results for degraded water quality, nor does it evaluate

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[7] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[8] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[9] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[10] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

the cumulative or indirect impacts of proposed minimum thresholds on DACs, drinking water users, or tribes.

RECOMMENDATIONS
Chronic Lowering of Groundwater Levels ● Describe direct and indirect impacts on drinking water users, DACs, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels. **Degraded Water Quality** ● Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[11] ● Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes. ● In Table 5-3 (Water Quality Standards for Selected Constituents of Concern), compare WQOs, MCLs, and ambient (prior to January 2015) water quality concentrations. Ensure that the most protective value is chosen for the minimum threshold. ● Set minimum thresholds and measurable objectives for all water quality constituents within the EMA. Ensure they align with drinking water standards.[12]

Groundwater Dependent Ecosystems and Interconnected Surface Waters

When defining undesirable results for chronic lowering of groundwater levels, the GSP states that high rate of pumping in the Paso Robles Formation or Careaga Sand could result in potential impacts to GDEs (p. 5-13). However, these impacts are not described or analyzed. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise these environmental beneficial users. Since GDEs may be present in areas of the EMA that are not adjacent to ISW (see our comments in the GDE section of this letter), they must also be considered when developing SMC for chronic lowering of groundwater levels.

For depletion of interconnected surface water, the GSP mentions, but does not sufficiently analyze, the impacts of minimum thresholds on terrestrial GDEs. The GSP states: *"The minimum threshold for this sustainability indicator is presented below and in Table 5-6: Groundwater levels measured at the piezometers proposed to be installed in the GDE areas of Alamo Pintado and Zanja de Cota Creek are 15 feet below the stream bed. This minimum threshold was selected because it represents the lowest groundwater level that most GDE plants can typically access with their roots, assuming that capillary action will bring groundwater further up into the profile. It is also intended to ensure that groundwater use does not significantly reduce the flow of surface water from the tributaries into the Santa Ynez River.*" Furthermore, the GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of

[11] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.
[12] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the EMA, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- Define chronic lowering of groundwater SMC directly for environmental beneficial users of groundwater. When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact on GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the EMA.[13] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[14]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the EMA are reached.[15] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on both environmental beneficial users of groundwater and surface water as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,16]

- When establishing SMC for the basin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently

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[13] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[14] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[15] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[16] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

account for the range of potential climate futures.[17] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[18] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the EMA. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

The GSP incorporates climate change into key inputs (e.g., precipitation and evapotranspiration) of the projected water budget. However, imported water should also be adjusted for climate change and incorporated into the surface water flow inputs of the projected water budget. Furthermore, the GSP does not provide a sustainable yield based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of projected climate change effects on imported water inputs, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change into surface water flow inputs, including imported water, for the projected water budget.
- Estimate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

[17] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]
[18] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent shallow groundwater elevations around GDEs in the EMA. Figure 4-2 (Groundwater Level Monitoring Network Low Well Density Areas) does highlight the areas of data gaps in the EMA based on well density in the EMA. The GSP, however, does not specifically acknowledge data gaps in the GDE monitoring network for the Category B potential GDEs noted in Section 3.2.6 (Groundwater Dependent Ecosystems).

Because maps of RMSs did not include DACs, tribes, domestic wells, and GDE mapping layers, it was difficult to determine whether or not the RMSs adequately represent water quality conditions and shallow groundwater elevations around DACs, tribes, domestic wells, and GDEs in the EMA.

RECOMMENDATION

- Provide maps that overlay monitoring well locations with the locations of DACs, domestic wells, tribes, and GDEs to clearly identify potentially impacted areas.
- Increase the number of RMSs in the shallow aquifer across the EMA as needed to adequately monitor shallow groundwater elevations supporting beneficial users such as GDEs and shallow domestic wells.
- Provide specific plans, such as locations and a timeline, to fill the data gaps in the GDE monitoring network. Evaluate how the gathered data will be used to identify and map GDEs.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, and drinking water users.

The proposed projects and management actions that would improve the water supply, GDE habitats, or provide benefits to DACs within the EMA are currently classified as Group 2 or 3 projects, and the GSA does not have specific plans to develop these projects. Therefore, potential project and management actions may not protect beneficial users during the GSP implementation phase. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

We recommend including specific plans to implement a drinking water well impact mitigation program since the SMC section of the GSP outlines that up to 39% of domestic wells will be impacted at minimum thresholds.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- The GSP discusses the Group 3 Project: Distributed Stormwater Managed Aquifer Recharge (DSW-MAR). Note that recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For further guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[19]

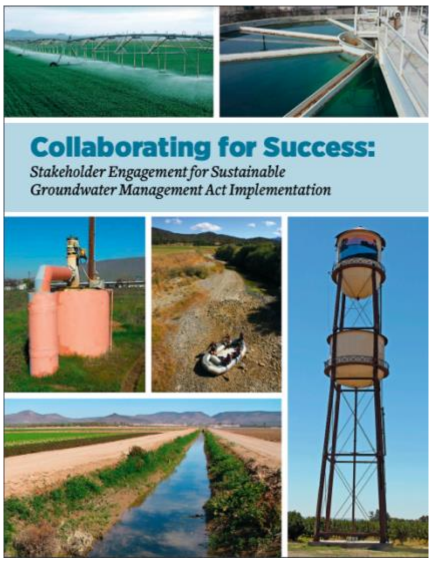
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[19] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



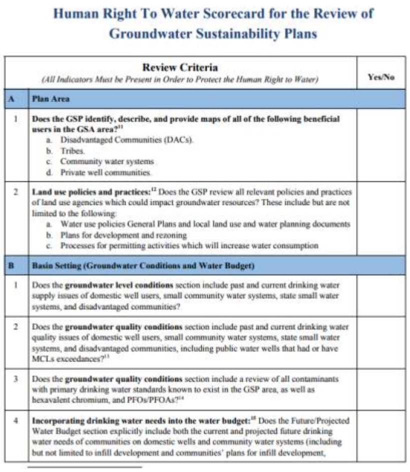
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

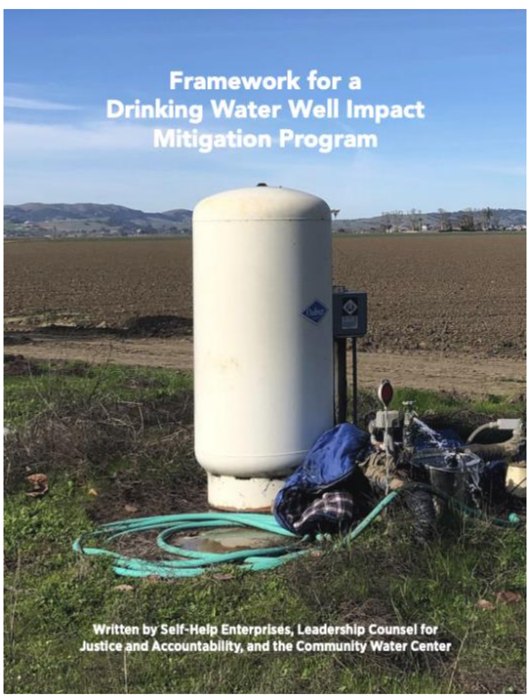


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

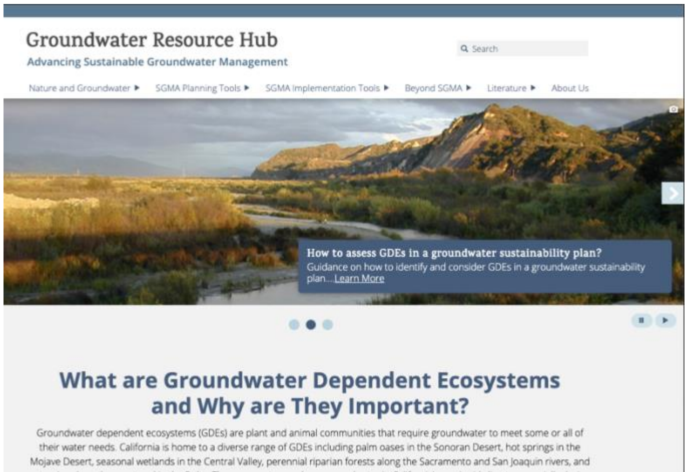
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



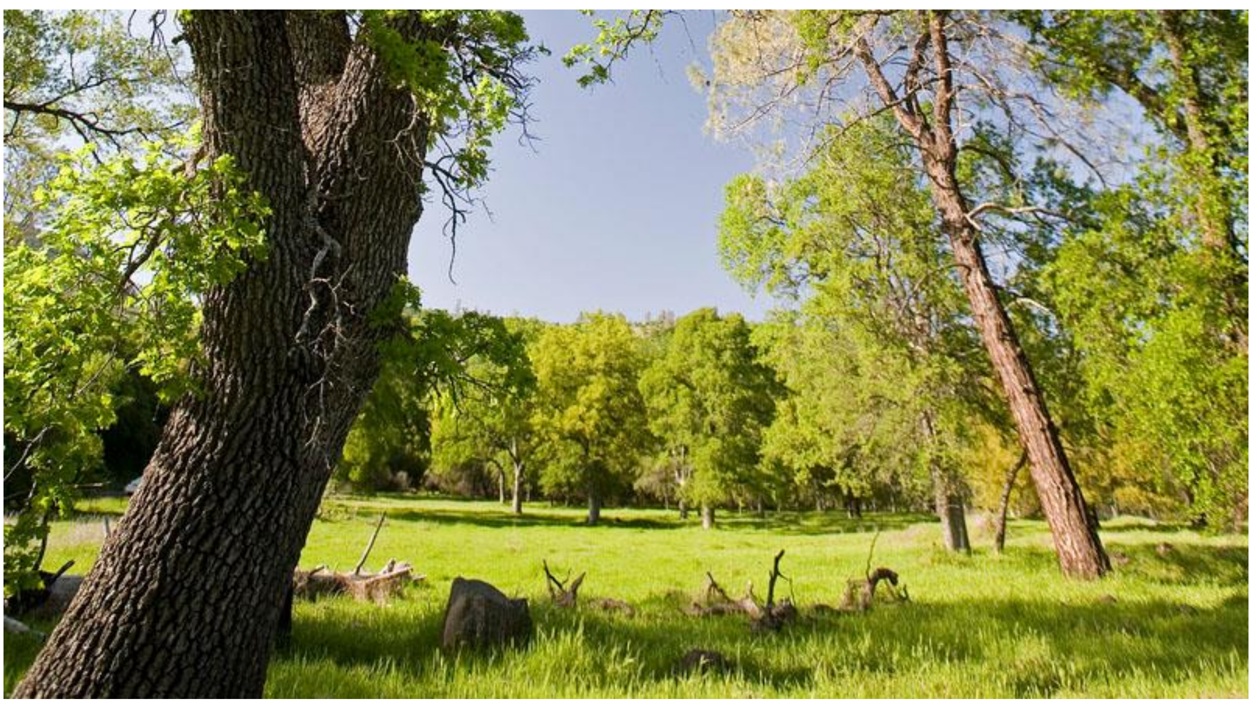
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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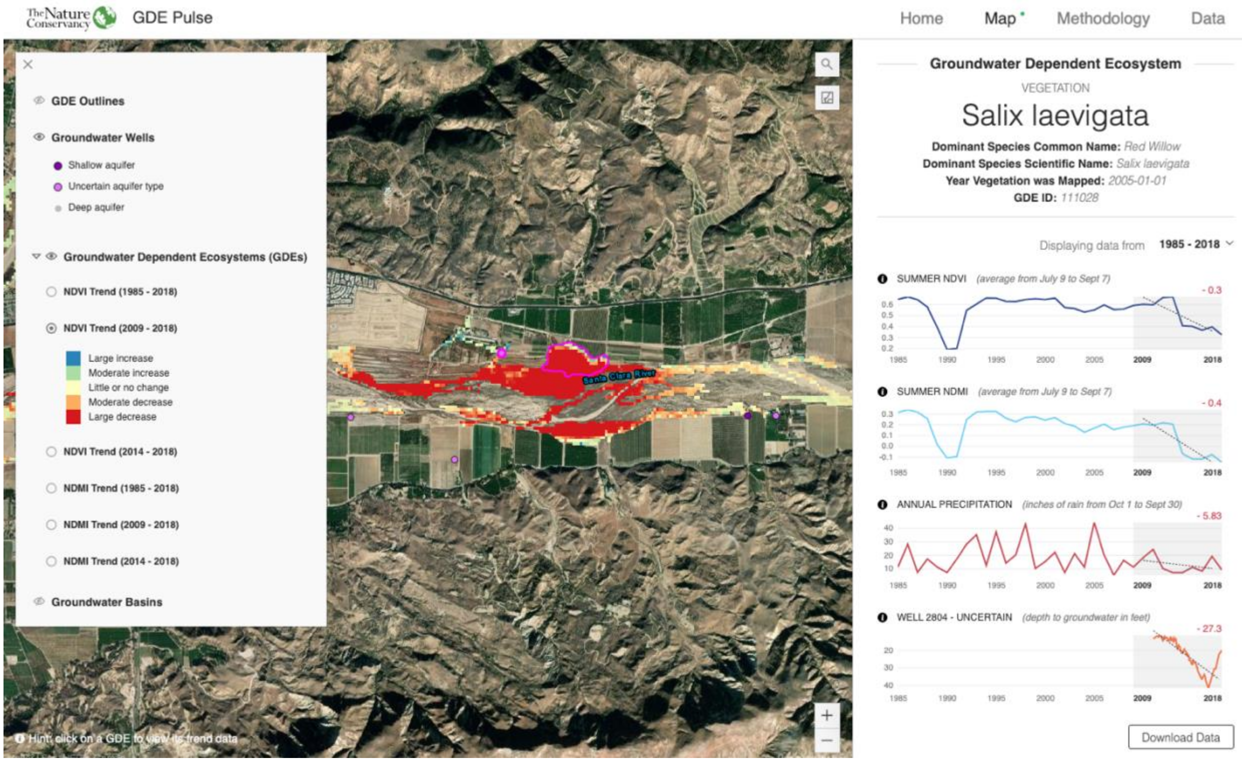
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

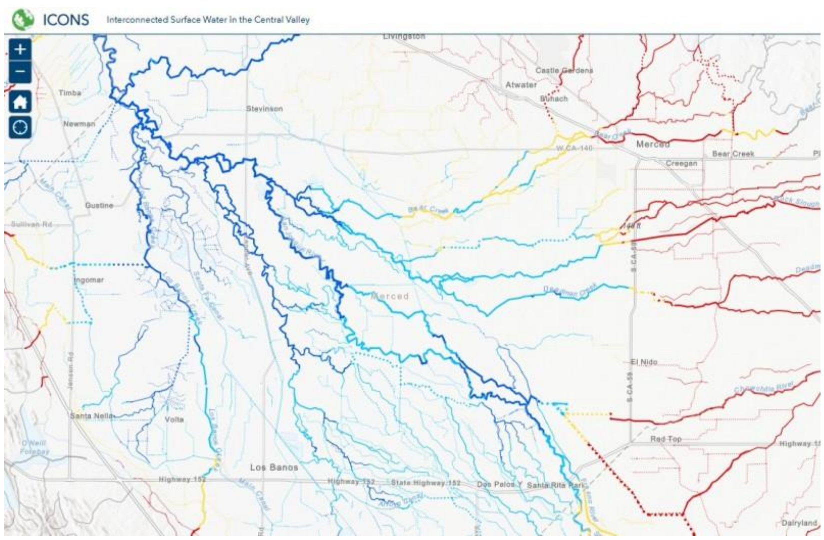
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Santa Ynez River Valley Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Santa Ynez River Valley Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gelochelidon nilotica vanrossemi	Gull-billed Tern	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Laterallus jamaicensis coturniculus	California Black Rail	Bird of Conservation Concern	Threatened	
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			

Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oreothlypis luciae	Lucy's Warbler		Special Concern	BSSC - Third priority
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Rynchops niger	Black Skimmer			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Americorophium spinicorne				Not on any status lists
Cyprididae fam.	Cyprididae fam.			
Gammarus spp.	Gammarus spp.			
Hyalella spp.	Hyalella spp.			
Neomysis mercedis				Not on any status lists
Ramellogammarus spp.	Ramellogammarus spp.			
FISH				
Eucyclogobius newberryi	Tidewater goby	Endangered	Special Concern	Vulnerable - Moyle 2013
Gasterosteus aculeatus williamsoni	Unarmored threespine stickleback	Endangered	Endangered	Endangered - Moyle 2013

Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus mykiss - Southern CA	Southern California steelhead	Endangered	Special Concern	Endangered - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Pseudacris cadaverina	California Treefrog			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Anaxyrus boreas halophilus	California Toad			ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
Thamnophis atratus atratus	Santa Cruz Gartersnake			Not on any status lists
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis elegans terrestris	Coast Gartersnake			Not on any status lists
Thamnophis sirtalis infernalis	California Red-sided Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Acentrella spp.	Acentrella spp.			
Acilius abbreviatus				Not on any status lists
Agabinus glabrellus				Not on any status lists
Agabus disintegratus				Not on any status lists
Agabus lutosus				Not on any status lists
Agabus spp.	Agabus spp.			
Agapetus spp.	Agapetus spp.			

Ambrysus spp.	Ambrysus spp.			
Anacaena signaticollis				Not on any status lists
Anax junius	Common Green Darner			
Anax spp.	Anax spp.			
Anisitsiellidae fam.	Anisitsiellidae fam.			
Apedilum spp.	Apedilum spp.			
Archilestes grandis	Great Spreadwing			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetidae fam.	Baetidae fam.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Belostomatidae fam.	Belostomatidae fam.			
Berosus infuscatus				Not on any status lists
Berosus punctatissimus				Not on any status lists
Caenis bajaensis	A Mayfly			
Caenis spp.	Caenis spp.			
Callibaetis spp.	Callibaetis spp.			
Caudatella spp.	Caudatella spp.			
Centroptilum spp.	Centroptilum spp.			
Chaetarthria magna				Not on any status lists
Chaetarthria punctulata				Not on any status lists
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus anonymus				Not on any status lists
Chironomus spp.	Chironomus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Colymbetes strigatus				Not on any status lists
Copelatus glyphicus				Not on any status lists
Cordulegaster dorsalis	Pacific Spiketail			
Corisella spp.	Corisella spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus annulator				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cybister ellipticus				Not on any status lists
Cymbiodyta columbiana				Not on any status lists

Cymbiodyta dorsalis				Not on any status lists
Cymbiodyta pacifica				Not on any status lists
Dicrotendipes adnilus				Not on any status lists
Dicrotendipes spp.	Dicrotendipes spp.			
Dytiscidae fam.	Dytiscidae fam.			
Dytiscus marginicollis				Not on any status lists
Enallagma cyathigerum				Not on any status lists
Enallagma praevarum	Arroyo Bluet			
Enallagma spp.	Enallagma spp.			
Enochrus californicus				Not on any status lists
Enochrus carinatus				Not on any status lists
Enochrus cristatus				Not on any status lists
Enochrus cuspidatus				Not on any status lists
Enochrus piceus				Not on any status lists
Enochrus pygmaeus				Not on any status lists
Ephydridae fam.	Ephydridae fam.			
Eubrianax edwardsii				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Helichus spp.	Helichus spp.			
Helichus suturalis				Not on any status lists
Hetaerina americana	American Rubyspot			
Heterocerus mexicanus				Not on any status lists
Hydrobius fuscipes				Not on any status lists
Hydrophilidae fam.	Hydrophilidae fam.			
Hydrophilus triangularis				Not on any status lists
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ischnura perparva	Western Forktail			
Labrundinia spp.	Labrundinia spp.			
Laccobius spp.	Laccobius spp.			

Laccophilus maculosus				Not on any status lists
Lauterborniella spp.	Lauterborniella spp.			
Libellula saturata	Flame Skimmer			
Limnophyes asquamatus				Not on any status lists
Limnophyes spp.	Limnophyes spp.			
Liodessus obscurellus				Not on any status lists
Microcylloepus spp.	Microcylloepus spp.			
Micropsectra nigripila				Not on any status lists
Micropsectra spp.	Micropsectra spp.			
Nectopsyche spp.	Nectopsyche spp.			
Neoclypeodytes pictodes				Not on any status lists
Neoclypeodytes plicipennis				Not on any status lists
Ochthebius apache				Not on any status lists
Ochthebius discretus				Not on any status lists
Ochthebius puncticollis				Not on any status lists
Ochthebius spp.	Ochthebius spp.			
Optioservus spp.	Optioservus spp.			
Orthocladius appersoni				Not on any status lists
Orthocladius spp.	Orthocladius spp.			
Oxyethira spp.	Oxyethira spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Peltodytes callosus				Not on any status lists
Peltodytes spp.	Peltodytes spp.			
Pentaneura spp.	Pentaneura spp.			
Plathemis lydia	Common Whitetail			
Procloeon venosum	A Mayfly			
Pseudochironomus spp.	Pseudochironomus spp.			
Pseudosmittia forcipata				Not on any status lists
Pseudosmittia spp.	Pseudosmittia spp.			
Psychodidae fam.	Psychodidae fam.			
Rhantus anisonychus				Not on any status lists
Rhantus gutticollis				Not on any status lists

Rhantus wallisi				Not on any status lists
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Serratella micheneri	A Mayfly			
Sigara spp.	Sigara spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sperchontidae fam.	Sperchontidae fam.			
Stictotarsus griseostriatus				Not on any status lists
Stictotarsus spp.	Stictotarsus spp.			
Stictotarsus striatellus				Not on any status lists
Sympetrum illotum	Cardinal Meadowhawk			
Tanytarsus spp.	Tanytarsus spp.			
Tramea lacerata	Black Saddlebags			
Trichocorixa arizonensis				Not on any status lists
Trichocorixa spp.	Trichocorixa spp.			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus californicus				Not on any status lists
Tropisternus spp.	Tropisternus spp.			
Uvarus subtilis				Not on any status lists
Zaitzevia parvula				Not on any status lists
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
MOLLUSKS				
Gyraulus vermicularis	Pacific Coast Gyraulus			CS
Physa acuta	Pewter Physa			Not on any status lists
Physa spp.	Physa spp.			
Physella virgata	Protean Physa			CS
Planorbella trivolvis	Marsh Rams-horn			CS
Planorbidae fam.	Planorbidae fam.			
Sphaerium occidentale				Not on any status lists
Sphaerium spp.	Sphaerium spp.			
Vorticifex spp.	Vorticifex spp.			
PLANTS				
Lasthenia glabrata coulteri	Coulter's Goldfields		Special	CRPR - 1B.1
Alnus rhombifolia	White Alder			

Alopecurus carolinianus	Tufted Foxtail			
Alopecurus saccatus	Pacific Foxtail			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla filiculoides	NA			
Baccharis glutinosa	NA			Not on any status lists
Berula erecta	Wild Parsnip			
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Callitriche marginata	Winged Water-starwort			
Carex harfordii	Harford's Sedge			
Carex pellita	Woolly Sedge			
Carex senta	Western Rough Sedge			
Ceratophyllum demersum	Common Hornwort			
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Downingia cuspidata	Toothed Calicoflower			
Elatine brachysperma	Shortseed Waterwort			
Elatine californica	California Waterwort			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Eleocharis parishii	Parish's Spikerush			
Epilobium campestre	NA			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Helenium puberulum	Rosilla			
Hypericum anagalloides	Tinker's-penny			
Isoetes howellii	NA			
Isolepis cernua	Low Bulrush			
Jaumea carnosa	Fleshy Jaumea			
Juncus effusus effusus	NA			
Juncus falcatus falcatus	Sickle-leaf Rush			
Juncus phaeocephalus phaeocephalus	Brown-head Rush			
Juncus textilis	Basket Rush			

Juncus xiphioides	Iris-leaf Rush			
Lemna minuta	Least Duckweed			
Mimulus guttatus	Common Large Monkeyflower			
Muhlenbergia utilis	Aparejo Grass			
Nasturtium gambelii	NA	Endangered	Threatened	CRPR - 1B.1
Oenanthe sarmentosa	Water-parsley			
Persicaria lapathifolia				Not on any status lists
Phacelia distans	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys undulatus	NA			Not on any status lists
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Populus trichocarpa	NA			Not on any status lists
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus tenellus	NA			
Rumex conglomeratus	NA			
Rumex fueginus				Not on any status lists
Rumex salicifolius salicifolius	Willow Dock			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Samolus parviflorus	NA			Not on any status lists
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus californicus	California Bulrush			
Schoenoplectus pungens pungens	NA			
Scirpus microcarpus	Small-fruit Bulrush			
Sinapis alba	NA			
Sparganium eurycarpum eurycarpum				
Stachys chamissonis chamissonis	Coast Hedge-nettle			
Stachys pycnantha	Short-spike Hedge-nettle			

Stuckenia pectinata				Not on any status lists
Triglochin scilloides	NA			Not on any status lists
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	NA			
Veronica peregrina	NA			
Wolffiella lingulata	Tongue Bogmat			
Zannichellia palustris	Horned Pondweed			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

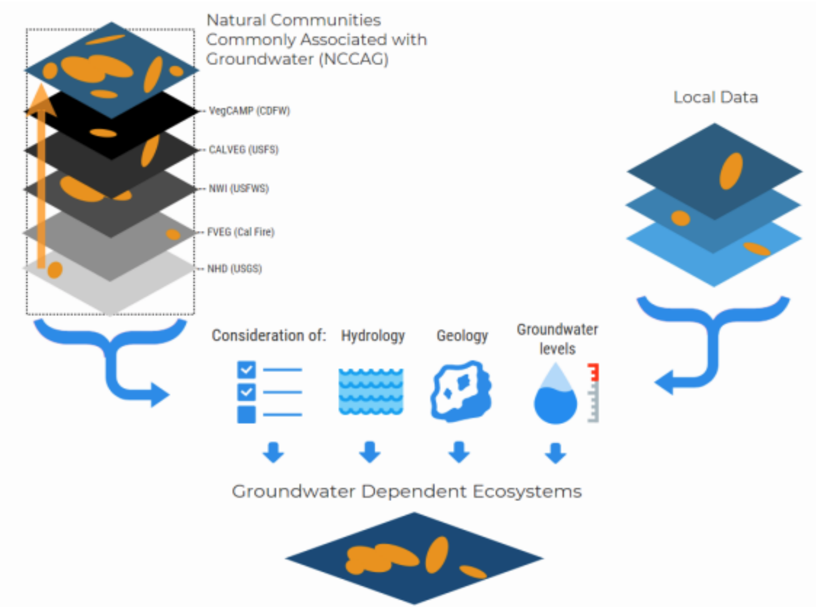


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

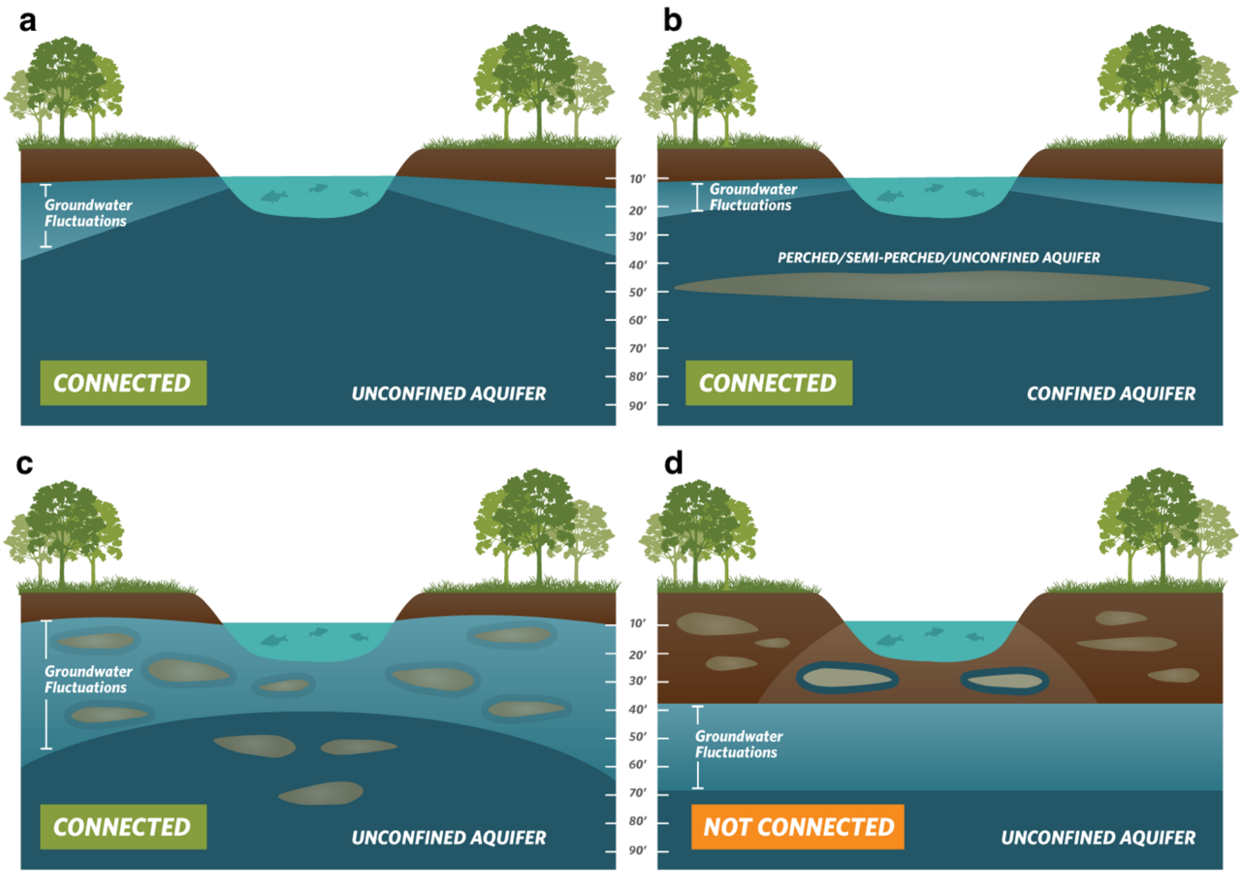

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

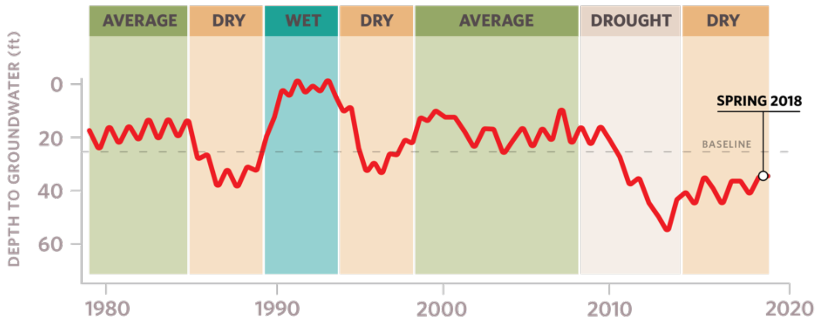

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

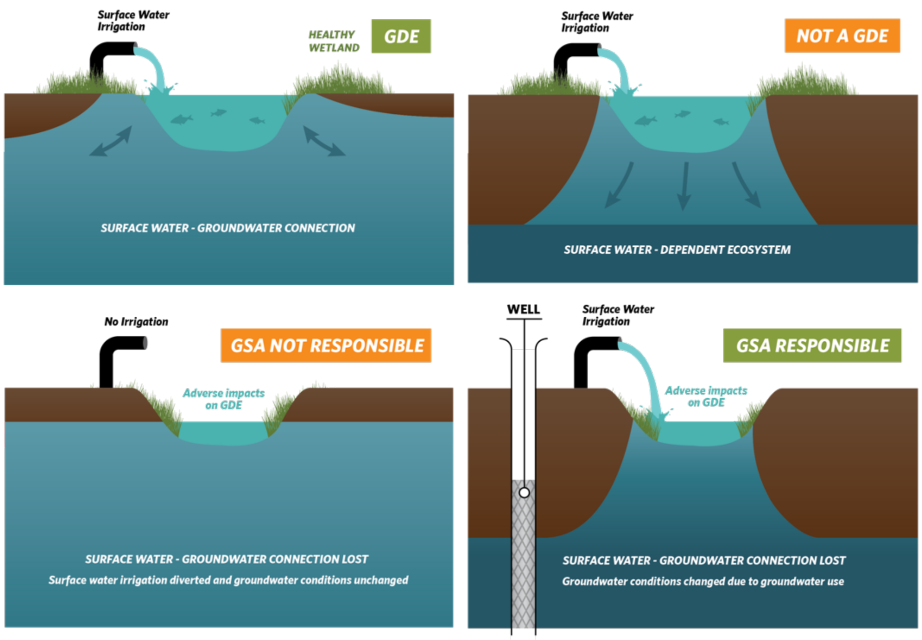

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

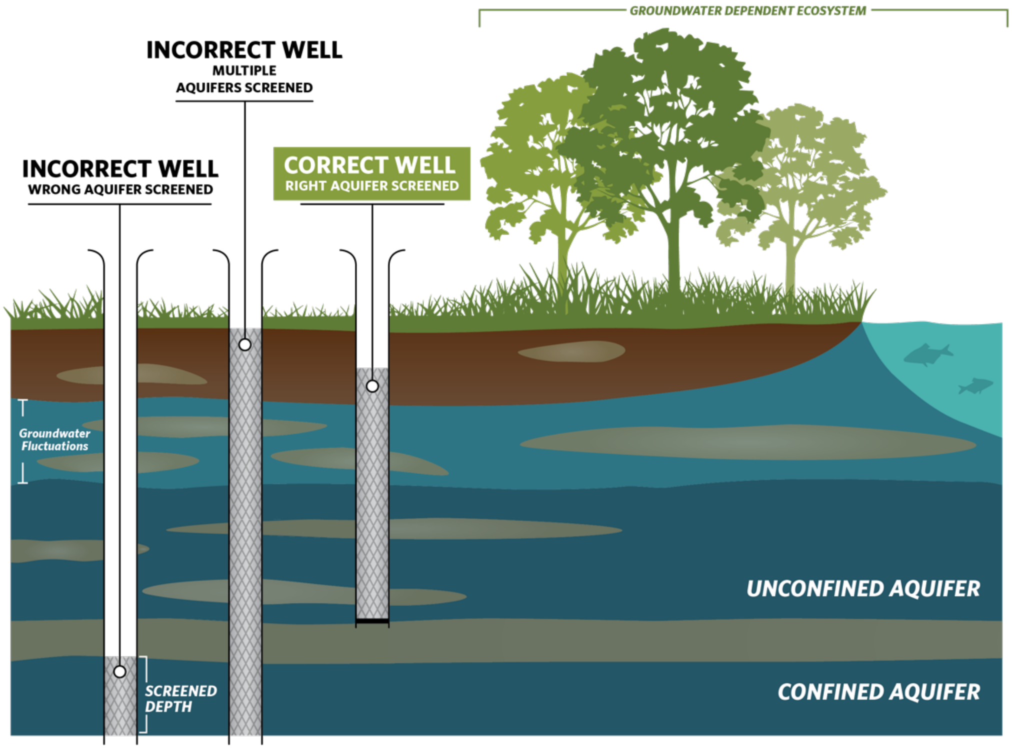

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

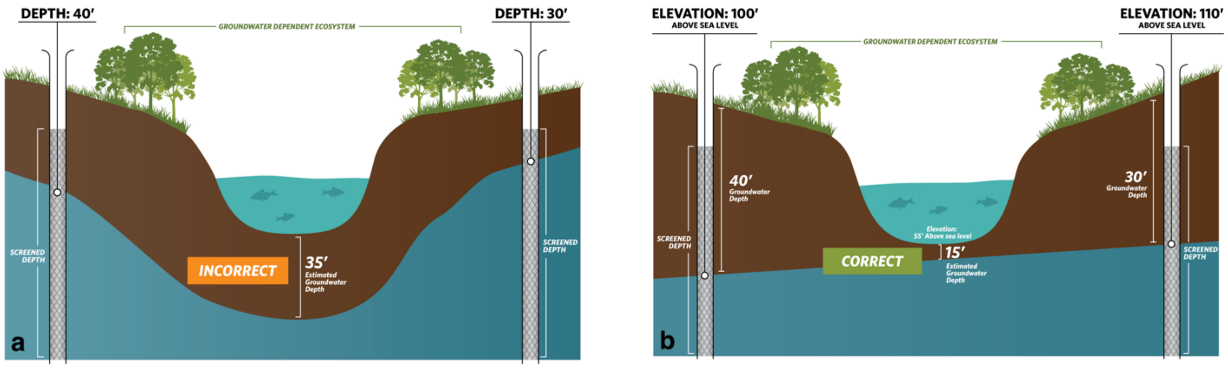

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

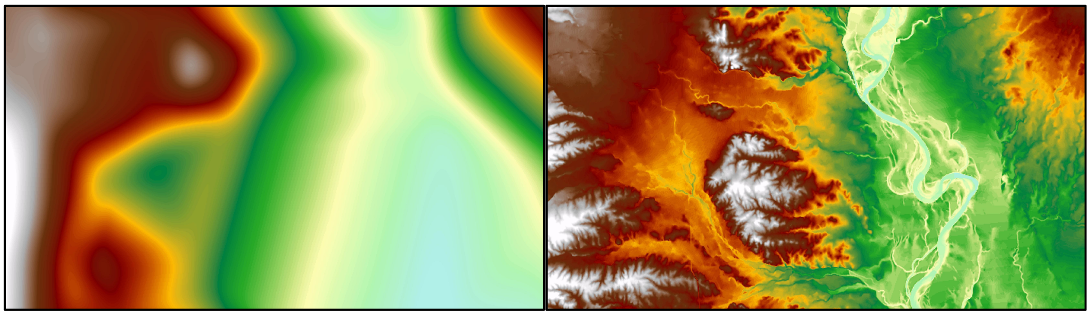

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

October 26, 2021

Santa Ynez River Valley Basin Western Management Area GSA
P.O. BOX 719
Santa Ynez CA 93460

Submitted via web: https://portal.santaynezwater.org/comment/new?gsaKey=WMA

Re: Public Comment Letter for Santa Ynez River Valley Western Management Area Draft GSP

Dear Bill Buelow,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Santa Ynez River Valley Basin Western Management Area being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
   a. Human Right to Water considerations **are not sufficiently** incorporated.
   b. Public trust resources **are not sufficiently** considered.
   c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Santa Ynez River Valley Basin Western Management Area Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
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E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Santa Ynez River Valley Basin
Western Management Area (WMA) Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP provides information on DACs, including identification by name and location on a map. While Figure 1d.6-2 identifies the population density of each identified DAC, the plan fails to clearly document the population of each DAC and the population dependent on groundwater as their source of drinking water in the Western Management Area (WMA).

While the plan provides a density map of domestic wells in the WMA, the GSP fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range).

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide the population of each identified DAC and identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). • Include a map showing domestic well locations and average well depth across the WMA.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

Interconnected Surface Waters
The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis.

The ISW Section of the GSP (Section 2b.6-1) begins with the following statement (p. 2b-40): *"The portion of the Santa Ynez River between the Lompoc Narrows and the Pacific Ocean is identified as seasonally interconnected surface water because at times surface water in this reach is hydraulically connected to the underlying water table in the principal aquifer. The reach is considered seasonally interconnected because the Santa Ynez River is dry for significant periods of time during the year, and as a result is not "hydraulically connected" to the underlying water table."* Note the regulations [23 CCR §351(o)], which are cited in several places in the GSP, define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

The GSP continues (p. 2b-40): *"In the WMA upstream of the Lompoc Narrows, as discussed in the HCM, the Santa Ynez River Alluvium is considered part of the underflow of the river, which is managed by the SWRCB."* The HCM section states (p. 2a-11): *"The subflow of the Santa Ynez River flowing through the Santa Ynez River alluvium upstream of the Lompoc Narrows is managed by SWRCB pursuant to WR 2019-0148 and other orders and decisions, and is also not a principal aquifer."* However, no further explanation or discussion is provided, such as citations from the SWRCB Order, a map showing the relevant section of the river, or cross-section of the river and shallow alluvium have been permitted, licensed and managed as "underflow" by the SWRCB. According to California's Electronic Water Rights Information Management System (eWRIMS), there are no water rights permits that fall under "underflow" within the WMA (Figure 1). While a few water rights may have "underflow" permits or licenses in the Central Management Area (5 active and 1 inactive) and Eastern Management Area (2 active and 7 inactive), the GSP has failed to substantiate the assertion that the WMA shallow aquifer - **in its entirety** - is classified and managed as "underflow" by the SWRCB. We are generally concerned that the GSP is grossly extrapolating the existence of "underflow" in the shallow alluvium across the entire basin from a limited number of "underflow" points of diversions within the basin (yet outside the WMA) that are actually managed by SWRCB. If the SWRCB is not managing the entire shallow aquifer as "underflow" and the beneficial users of groundwater and surface water reliant on it - this water is actually groundwater and is instead subject to SGMA regulations.

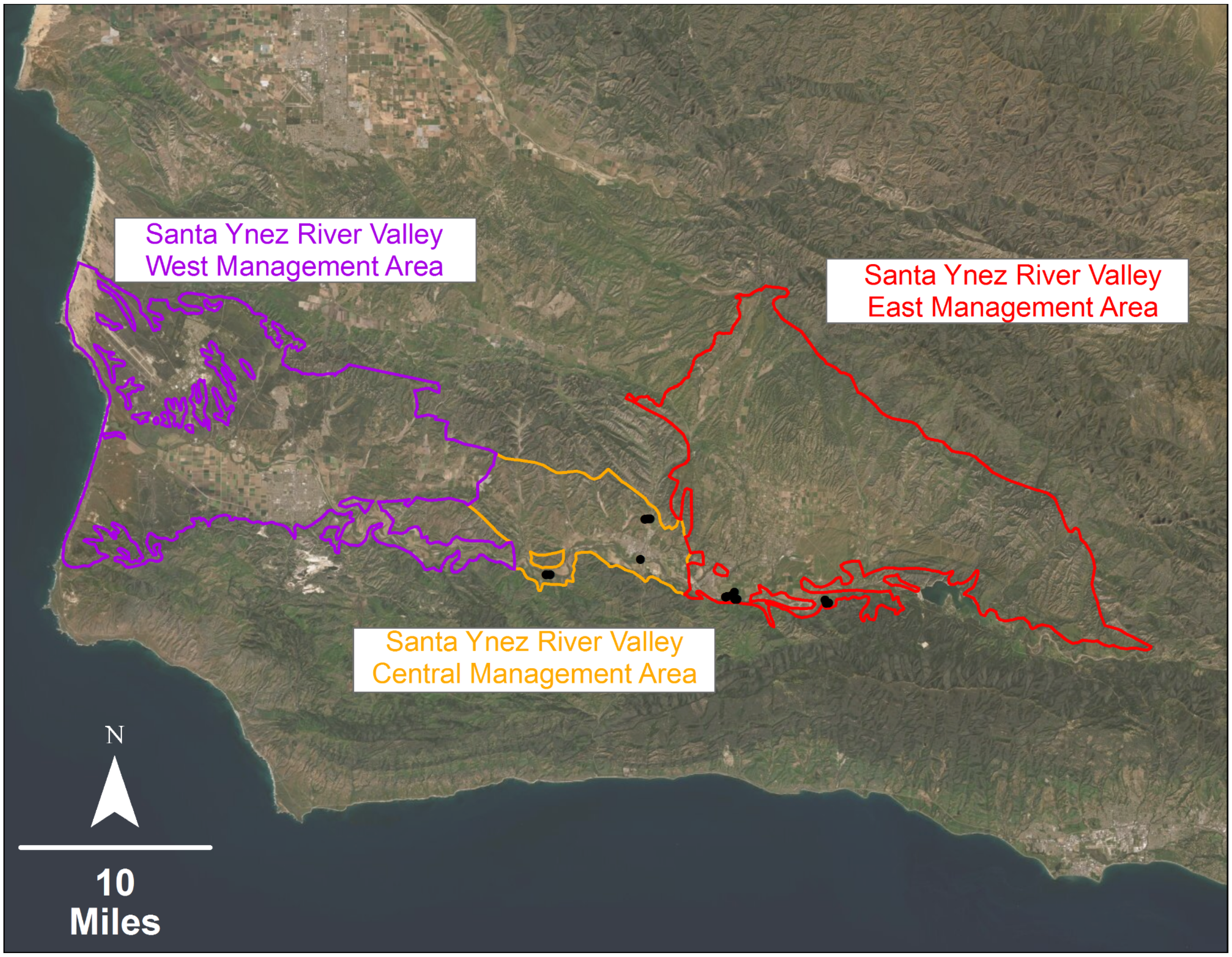

Figure 1. Points of Diversion (black circles) classified as "Santa Ynez River Underflow" within the Central Management Area (CMA; orange) and Eastern Management Area (EMA; red). No "underflow" points of diversion were located in the Western Management Area (WMA; purple). Data Source: eWRIMS.

The GSP continues further (p. 2b-43): *"All of the tributaries within the WMA (Figure 2b.6-1) are ephemeral. Several small streams flow year-round in canyons outside of the WMA and south of the Lompoc Plain (Bright et al. 1997). Once these flows reach the unconsolidated alluvial deposits within the boundary of the WMA, all of the flow infiltrates and recharges the groundwater. Thus, the perennial flows in these tributaries are not influenced by groundwater management actions in the WMA and would not be classified as having interconnected surface water under SGMA because they are disconnected from the water table in the primary aquifer and "completely depleted" as sources of groundwater recharge in the WMA."* By disregarding ephemeral streams without modelling groundwater-surface water interactions or analyzing depth-to-groundwater data, the GSP disregards possible short durations of interconnections of groundwater and surface water that define interconnected surface water.

The GSP does not provide a map or concluding statement regarding which reaches in the WMA are considered interconnected (gaining/losing) or disconnected.

RECOMMENDATIONS
● Provide a map showing all the stream reaches in the WMA, with reaches clearly labeled as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP. ● Substantiate the assertion that the shallow aquifer - **in its entirety** - is classified and managed as "underflow" by the SWRCB. Discuss SWRCB Order WR 2019-0148 and explain how it relates to the definition of ISW in the WMA. Cite relevant sections of the order, maps, and cross-sections. ● Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. ● Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015. ● Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, we found that some mapped features in the NC dataset were improperly disregarded, as described below.

- NC dataset polygons were incorrectly removed If depth to groundwater has historically exceeded the 30-foot depth identified by the Nature Conservancy as representative of groundwater conditions that may sustain common phreatophytes and wetland ecosystems. However, description of the groundwater data used for the 30-foot threshold analysis is not provided in the GSP text. If it is the fall 2019 and spring 2020 data described in Section 2b.1-2 (Groundwater Elevation Contour Maps), then this data does not provide sufficient seasonal and temporal variability and it is after the 2015 SGMA benchmark date
- NC dataset polygons were incorrectly removed from riparian areas of the Santa Ynez River if identified as being "underflow" and managed by the SWRCB. However, as stated above under the ISW section of this letter, the GSP has failed to substantiate the assertion that the shallow aquifer - **in its entirety** - is classified and managed as "underflow" by the SWRCB, nor has the GSP provided a sufficient explanation of how the SWRCB Order relates to groundwater management in the WMA.

RECOMMENDATIONS

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a pre-SGMA baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as valley oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- Show the extent of the shallow aquifer that is classified and managed as "underflow" by the SWRCB. For example, include a map and description of extraction points and whether they source "underflow" or "groundwater" from the shallow alluvium. Discuss SWRCB Order WR 2019-0148 and explain how it relates to SGMA and the definition of ISW in the WMA. Cite relevant sections of the order, maps, and cross-sections.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of native vegetation into the water budget is **sufficient**. We commend the GSA for including the groundwater demands of this ecosystem in the historical, current and projected water budgets. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the WMA.

[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

RECOMMENDATION
• State whether or not there are managed wetlands in the WMA. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development
Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Public Outreach and Engagement Plan (Appendix 1c-C).[4]

We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms and include attending GSA meetings and workshops, reading electronic newsletters, providing input on the draft and final GSP, and a Citizen Advisory Group. There are no specific details provided regarding targeted outreach to DACs, domestic well owners, and environmental stakeholders.

- The Public Outreach and Engagement Plan states that the residents within the DAC are represented on the WMA GSA by the City of Lompoc. However, it does not give more information about how their interests were represented.

- The Public Outreach and Engagement Plan does not include specific plans for continual engagement during the GSP *implementation* phase with DACs, domestic well owners, and environmental stakeholders.

RECOMMENDATIONS
• Include a more detailed and robust Public Outreach and Engagement Plan that describes active and targeted outreach to engage DAC members, domestic well owners, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. • Include plans to directly engage the DAC population for inclusion on the GSA advisory committee instead of having DACs represented by the City of Lompoc.

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the basin within the GSP.[5]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP presents a well impact analysis to assess the potential impacts of water level decline on domestic wells (Appendix 3b-B), which was used to determine the lower and upper aquifer groundwater level minimum thresholds for the WMA. For the lower aquifer, the GSP states (p. 3b-26): *"The minimum threshold for chronic lowering of groundwater levels in the Lower Aquifer was chosen by the WMA GSA at 20 feet below 2020 groundwater levels. Groundwater elevations 20 feet below 2020 levels corresponds to the top of well screens in approximately 22% of municipal supply wells, 39% of domestic supply wells, and 30% of agricultural supply wells completed in the Lower Aquifer."* For the upper aquifer, the GSP states (p. 3b-27): *"The minimum threshold groundwater elevations for the Upper Aquifer were established 10-feet below the 2020 groundwater elevation. Groundwater elevations 10 feet below the 2020 levels correspond to the groundwater elevations at or below top of well screens in approximately 15% of municipal supply wells, 15% of domestic supply wells, and 10% of agricultural supply wells."* Despite this well impact analysis, the GSP does not sufficiently describe whether these minimum thresholds will avoid significant and unreasonable loss of drinking water, especially given the absence of a well mitigation plan in the GSP.

In addition, the GSP does not, sufficiently describe or analyze direct or indirect impacts on DACs when defining undesirable results, nor does it describe how groundwater level minimum thresholds will avoid significant and unreasonable impacts to DACs and domestic well users beyond 2015 and be consistent with California's Human Right to Water policy.[9]

For degraded water quality, the GSP identifies the constituents of concern (COCs) in the WMA as the following: boron, chloride, total dissolved solids (TDS), sulfate, sodium, and nitrate. The minimum threshold for nitrate is set to the maximum contaminant level (MCL) of 10 mg/L for nitrate as nitrogen. For the other COCs, the minimum threshold concentrations are established at the median Water Quality Objectives (WQOs) established from the Central Coastal Basin Water

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[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

Quality Control Plan (CCBWQCP). The GSP does not compare the WQOs with MCLs to ensure the most protective values are chosen as minimum thresholds.

The GSP only includes a very general discussion of impacts to drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users and DACs when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users and DACs when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[10]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users and DACs.

- Provide a table in the GSP that compares WQOs to MCLs for all COCs. Ensure that the most protective value is chosen for the minimum threshold.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP only considers GDEs with respect to the depletion of interconnected surface water sustainability indicator, but not the chronic lowering of groundwater levels sustainability indicator. No analysis or discussion is provided in the GSP that describes impacts on GDEs or establishes SMC for GDEs that are directly dependent on groundwater. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise these environmental beneficial users. Since GDEs may be present in areas of the WMA that are not adjacent to ISW (see our comments in the GDE section of this letter), they must be considered when developing SMC for chronic lowering of groundwater levels.

For depletions of interconnected surface water, the GSP does not describe undesirable results to beneficial users of surface water, other than to say (p. 3b-21): *"Surface water releases through the Cachuma Reservoir to the WMA are managed by SWRCB under Order WR 2019-0148. The lowering of groundwater levels below historical lows in the Upper Aquifer potentially impacts habitat and ecosystem health along the Santa Ynez River."*

The GSP continues (p. 3b-21): *"Using groundwater levels adjacent to the Santa Ynez River in the Upper Aquifer, undesirable results associated with a depletion of interconnected surface water and groundwater will be quantified by measuring groundwater elevations semi-annually at three representative monitoring points located adjacent to the Santa Ynez River (Figure 3b.2-6) and*

[10] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

maintaining water levels above historical low groundwater levels." However, no analysis or discussion is presented to describe how the SMC will affect GDEs, or the impact of these minimum thresholds on GDEs in the WMA. Furthermore, the GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the WMA, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- Define chronic lowering of groundwater SMC directly for environmental beneficial users of groundwater. When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact on GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the WMA.[11] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[12]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the WMA are reached.[13] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,14]

- When establishing SMC for the basin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

[11] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[12] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[13] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]
[14] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[15] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[16] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the WMA. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

The GSP incorporates climate change into key inputs (e.g., precipitation and evapotranspiration) of the projected water budget. However, climate change was not incorporated into surface water flow inputs. Furthermore, the GSP does not provide a sustainable yield based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of projected climate change impacts on surface water flow inputs, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change into surface water flow inputs for the projected water budget.
- Estimate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

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[15] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[16] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Wells (RMWs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, GDEs, and ISWs in the WMA.

Figure 3a.3-1 (WMA Monitoring Network and Representative Monitoring Wells for Groundwater Levels and Groundwater Storage) shows insufficient representation of DACs and domestic wells for groundwater elevation monitoring. Figure 3a.3-2 (WMA Monitoring Network and Representative Monitoring Wells for Water Quality) shows insufficient representation of DACs and domestic wells for groundwater quality monitoring. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[17]

Figure 3a.3-5 (WMA Monitoring Network and Representative Monitoring for Groundwater Dependent Ecosystems) shows that representative wells should be added along the length of the Santa Ynez River to adequately cover the area of mapped GDEs. Additionally, our comments above under the GDE section of this letter note that GDEs may have been improperly disregarded in portions of the WMA that are non-adjacent to the Santa Ynez River. These data gaps for GDEs were not described in the GSP.

RECOMMENDATIONS
• Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, GDEs, and ISWs to clearly identify which beneficial users are not adequately being monitored spatially and at depth. • Increase the number of RMWs in the shallow aquifer across the WMA as needed to adequately monitor all groundwater condition indicators across the WMA and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMWs. • Provide specific plans to fill data gaps in the monitoring network. Evaluate how the gathered data will be used to identify and map GDEs and ISWs, and identify DACs and shallow domestic well users that are vulnerable to undesirable results. • Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the WMA.

[17] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

The GSP lists a PMA entitled "Drought Mitigation by Pumping Optimization and Deepen Existing Wells" (p. 4a-39), but the GSP states that it is not a current commitment that the GSA plans to implement. We recommend including specific plans to implement a drinking water well impact mitigation program since the SMC section of the GSP outlines that a significant percentage of domestic wells will be impacted at minimum thresholds.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- The GSP discusses Project Management Action No. 4: Increase Stormwater Recharge. Note that recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For further guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document".[18]

- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

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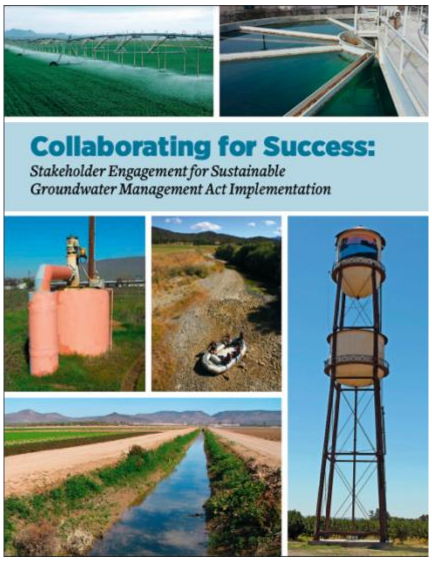
[18] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

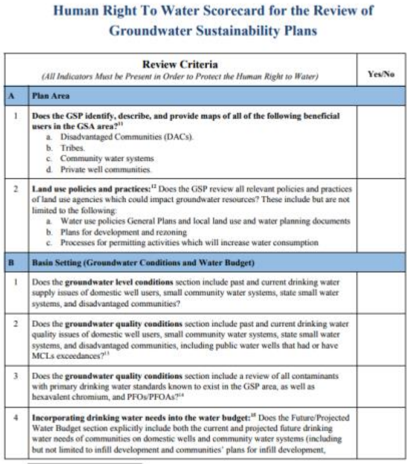
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

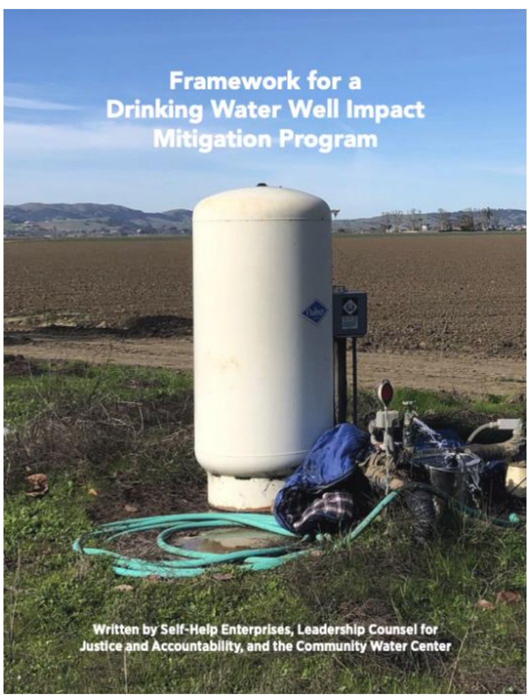


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

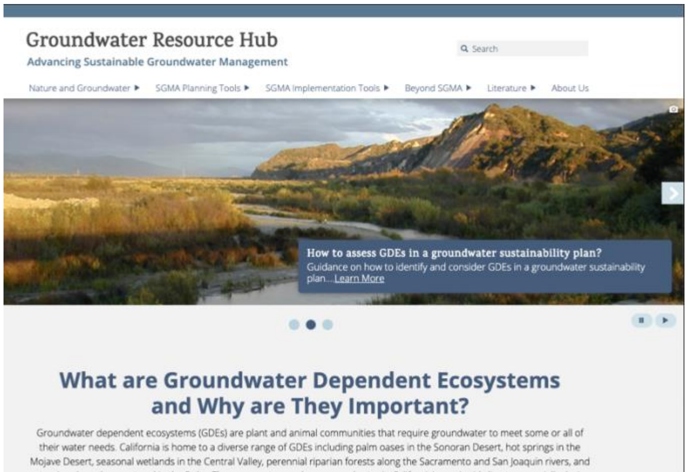
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



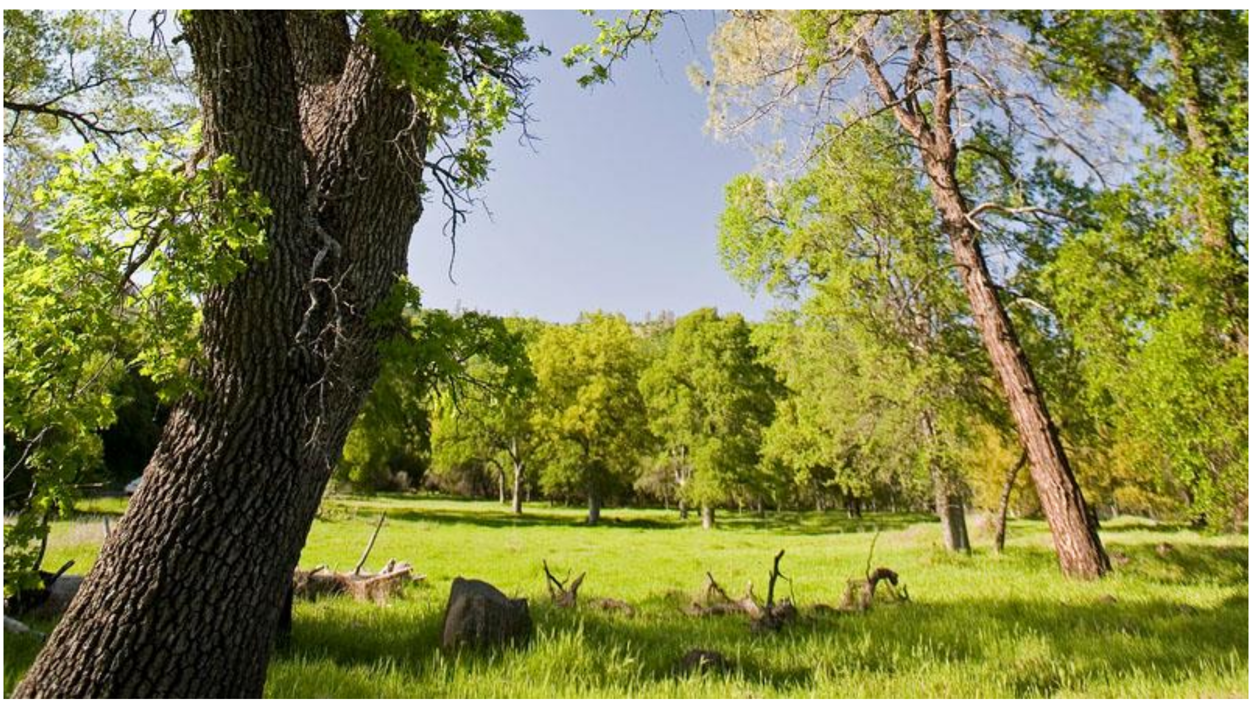
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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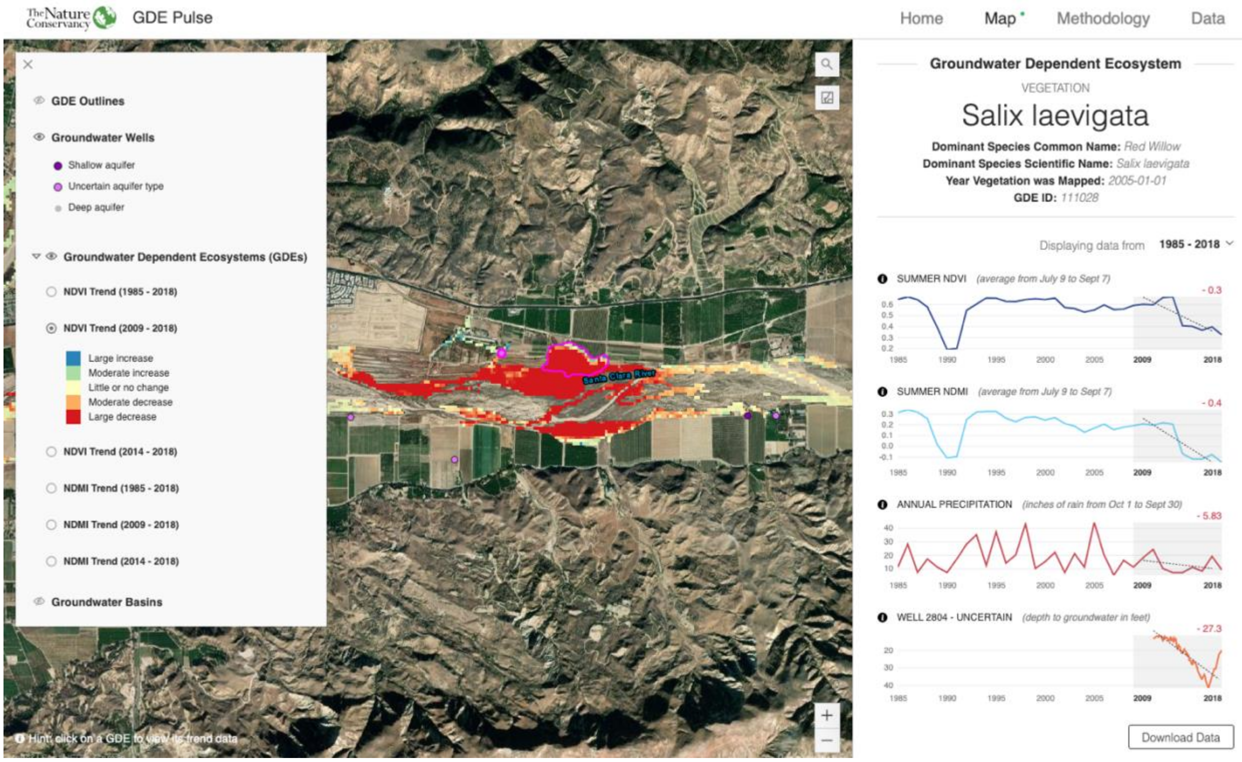
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

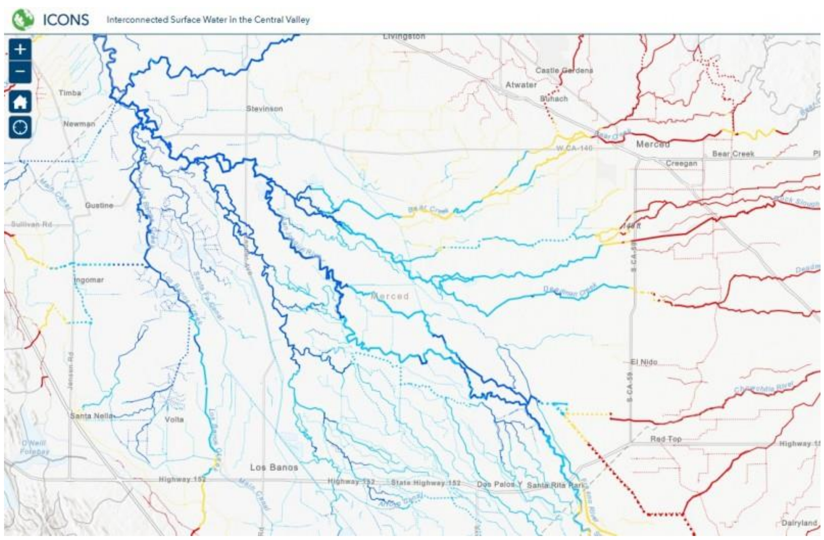
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Santa Ynez River Valley Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Santa Ynez River Valley Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gelochelidon nilotica vanrossemi	Gull-billed Tern	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Laterallus jamaicensis coturniculus	California Black Rail	Bird of Conservation Concern	Threatened	
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			

Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oreothlypis luciae	Lucy's Warbler		Special Concern	BSSC - Third priority
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Rynchops niger	Black Skimmer			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Americorophium spinicorne				Not on any status lists
Cyprididae fam.	Cyprididae fam.			
Gammarus spp.	Gammarus spp.			
Hyalella spp.	Hyalella spp.			
Neomysis mercedis				Not on any status lists
Ramellogammarus spp.	Ramellogammarus spp.			
FISH				
Eucyclogobius newberryi	Tidewater goby	Endangered	Special Concern	Vulnerable - Moyle 2013
Gasterosteus aculeatus williamsoni	Unarmored threespine stickleback	Endangered	Endangered	Endangered - Moyle 2013

Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus mykiss - Southern CA	Southern California steelhead	Endangered	Special Concern	Endangered - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Pseudacris cadaverina	California Treefrog			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Anaxyrus boreas halophilus	California Toad			ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
Thamnophis atratus atratus	Santa Cruz Gartersnake			Not on any status lists
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis elegans terrestris	Coast Gartersnake			Not on any status lists
Thamnophis sirtalis infernalis	California Red-sided Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Acentrella spp.	Acentrella spp.			
Acilius abbreviatus				Not on any status lists
Agabinus glabrellus				Not on any status lists
Agabus disintegratus				Not on any status lists
Agabus lutosus				Not on any status lists
Agabus spp.	Agabus spp.			
Agapetus spp.	Agapetus spp.			

Ambrysus spp.	Ambrysus spp.			
Anacaena signaticollis				Not on any status lists
Anax junius	Common Green Darner			
Anax spp.	Anax spp.			
Anisitsiellidae fam.	Anisitsiellidae fam.			
Apedilum spp.	Apedilum spp.			
Archilestes grandis	Great Spreadwing			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetidae fam.	Baetidae fam.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Belostomatidae fam.	Belostomatidae fam.			
Berosus infuscatus				Not on any status lists
Berosus punctatissimus				Not on any status lists
Caenis bajaensis	A Mayfly			
Caenis spp.	Caenis spp.			
Callibaetis spp.	Callibaetis spp.			
Caudatella spp.	Caudatella spp.			
Centroptilum spp.	Centroptilum spp.			
Chaetarthria magna				Not on any status lists
Chaetarthria punctulata				Not on any status lists
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus anonymus				Not on any status lists
Chironomus spp.	Chironomus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Colymbetes strigatus				Not on any status lists
Copelatus glyphicus				Not on any status lists
Cordulegaster dorsalis	Pacific Spiketail			
Corisella spp.	Corisella spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus annulator				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cybister ellipticus				Not on any status lists
Cymbiodyta columbiana				Not on any status lists

Cymbiodyta dorsalis				Not on any status lists
Cymbiodyta pacifica				Not on any status lists
Dicrotendipes adnilus				Not on any status lists
Dicrotendipes spp.	Dicrotendipes spp.			
Dytiscidae fam.	Dytiscidae fam.			
Dytiscus marginicollis				Not on any status lists
Enallagma cyathigerum				Not on any status lists
Enallagma praevarum	Arroyo Bluet			
Enallagma spp.	Enallagma spp.			
Enochrus californicus				Not on any status lists
Enochrus carinatus				Not on any status lists
Enochrus cristatus				Not on any status lists
Enochrus cuspidatus				Not on any status lists
Enochrus piceus				Not on any status lists
Enochrus pygmaeus				Not on any status lists
Ephydridae fam.	Ephydridae fam.			
Eubrianax edwardsii				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Helichus spp.	Helichus spp.			
Helichus suturalis				Not on any status lists
Hetaerina americana	American Rubyspot			
Heterocerus mexicanus				Not on any status lists
Hydrobius fuscipes				Not on any status lists
Hydrophilidae fam.	Hydrophilidae fam.			
Hydrophilus triangularis				Not on any status lists
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ischnura perparva	Western Forktail			
Labrundinia spp.	Labrundinia spp.			
Laccobius spp.	Laccobius spp.			

Laccophilus maculosus				Not on any status lists
Lauterborniella spp.	Lauterborniella spp.			
Libellula saturata	Flame Skimmer			
Limnophyes asquamatus				Not on any status lists
Limnophyes spp.	Limnophyes spp.			
Liodessus obscurellus				Not on any status lists
Microcylloepus spp.	Microcylloepus spp.			
Micropsectra nigripila				Not on any status lists
Micropsectra spp.	Micropsectra spp.			
Nectopsyche spp.	Nectopsyche spp.			
Neoclypeodytes pictodes				Not on any status lists
Neoclypeodytes plicipennis				Not on any status lists
Ochthebius apache				Not on any status lists
Ochthebius discretus				Not on any status lists
Ochthebius puncticollis				Not on any status lists
Ochthebius spp.	Ochthebius spp.			
Optioservus spp.	Optioservus spp.			
Orthocladius appersoni				Not on any status lists
Orthocladius spp.	Orthocladius spp.			
Oxyethira spp.	Oxyethira spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Peltodytes callosus				Not on any status lists
Peltodytes spp.	Peltodytes spp.			
Pentaneura spp.	Pentaneura spp.			
Plathemis lydia	Common Whitetail			
Procloeon venosum	A Mayfly			
Pseudochironomus spp.	Pseudochironomus spp.			
Pseudosmittia forcipata				Not on any status lists
Pseudosmittia spp.	Pseudosmittia spp.			
Psychodidae fam.	Psychodidae fam.			
Rhantus anisonychus				Not on any status lists
Rhantus gutticollis				Not on any status lists

Rhantus wallisi				Not on any status lists
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Serratella micheneri	A Mayfly			
Sigara spp.	Sigara spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sperchontidae fam.	Sperchontidae fam.			
Stictotarsus griseostriatus				Not on any status lists
Stictotarsus spp.	Stictotarsus spp.			
Stictotarsus striatellus				Not on any status lists
Sympetrum illotum	Cardinal Meadowhawk			
Tanytarsus spp.	Tanytarsus spp.			
Tramea lacerata	Black Saddlebags			
Trichocorixa arizonensis				Not on any status lists
Trichocorixa spp.	Trichocorixa spp.			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus californicus				Not on any status lists
Tropisternus spp.	Tropisternus spp.			
Uvarus subtilis				Not on any status lists
Zaitzevia parvula				Not on any status lists
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
MOLLUSKS				
Gyraulus vermicularis	Pacific Coast Gyraulus			CS
Physa acuta	Pewter Physa			Not on any status lists
Physa spp.	Physa spp.			
Physella virgata	Protean Physa			CS
Planorbella trivolvis	Marsh Rams-horn			CS
Planorbidae fam.	Planorbidae fam.			
Sphaerium occidentale				Not on any status lists
Sphaerium spp.	Sphaerium spp.			
Vorticifex spp.	Vorticifex spp.			
PLANTS				
Lasthenia glabrata coulteri	Coulter's Goldfields		Special	CRPR - 1B.1
Alnus rhombifolia	White Alder			

Alopecurus carolinianus	Tufted Foxtail			
Alopecurus saccatus	Pacific Foxtail			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla filiculoides	NA			
Baccharis glutinosa	NA			Not on any status lists
Berula erecta	Wild Parsnip			
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Callitriche marginata	Winged Water-starwort			
Carex harfordii	Harford's Sedge			
Carex pellita	Woolly Sedge			
Carex senta	Western Rough Sedge			
Ceratophyllum demersum	Common Hornwort			
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Downingia cuspidata	Toothed Calicoflower			
Elatine brachysperma	Shortseed Waterwort			
Elatine californica	California Waterwort			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Eleocharis parishii	Parish's Spikerush			
Epilobium campestre	NA			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Helenium puberulum	Rosilla			
Hypericum anagalloides	Tinker's-penny			
Isoetes howellii	NA			
Isolepis cernua	Low Bulrush			
Jaumea carnosa	Fleshy Jaumea			
Juncus effusus effusus	NA			
Juncus falcatus falcatus	Sickle-leaf Rush			
Juncus phaeocephalus phaeocephalus	Brown-head Rush			
Juncus textilis	Basket Rush			

Juncus xiphioides	Iris-leaf Rush			
Lemna minuta	Least Duckweed			
Mimulus guttatus	Common Large Monkeyflower			
Muhlenbergia utilis	Aparejo Grass			
Nasturtium gambelii	NA	Endangered	Threatened	CRPR - 1B.1
Oenanthe sarmentosa	Water-parsley			
Persicaria lapathifolia				Not on any status lists
Phacelia distans	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys undulatus	NA			Not on any status lists
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Populus trichocarpa	NA			Not on any status lists
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus tenellus	NA			
Rumex conglomeratus	NA			
Rumex fueginus				Not on any status lists
Rumex salicifolius salicifolius	Willow Dock			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Samolus parviflorus	NA			Not on any status lists
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus californicus	California Bulrush			
Schoenoplectus pungens pungens	NA			
Scirpus microcarpus	Small-fruit Bulrush			
Sinapis alba	NA			
Sparganium eurycarpum eurycarpum				
Stachys chamissonis chamissonis	Coast Hedge-nettle			
Stachys pycnantha	Short-spike Hedge-nettle			

Stuckenia pectinata				Not on any status lists
Triglochin scilloides	NA			Not on any status lists
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	NA			
Veronica peregrina	NA			
Wolffiella lingulata	Tongue Bogmat			
Zannichellia palustris	Horned Pondweed			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

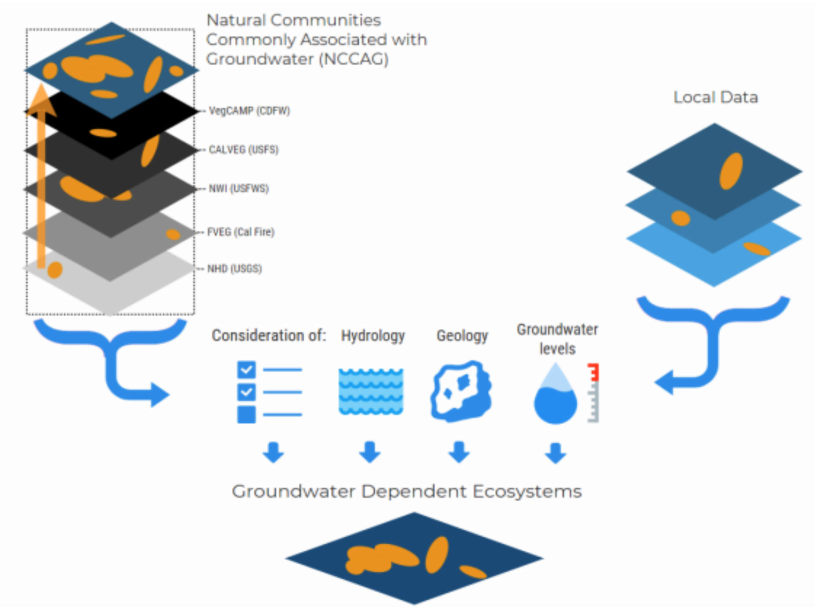


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

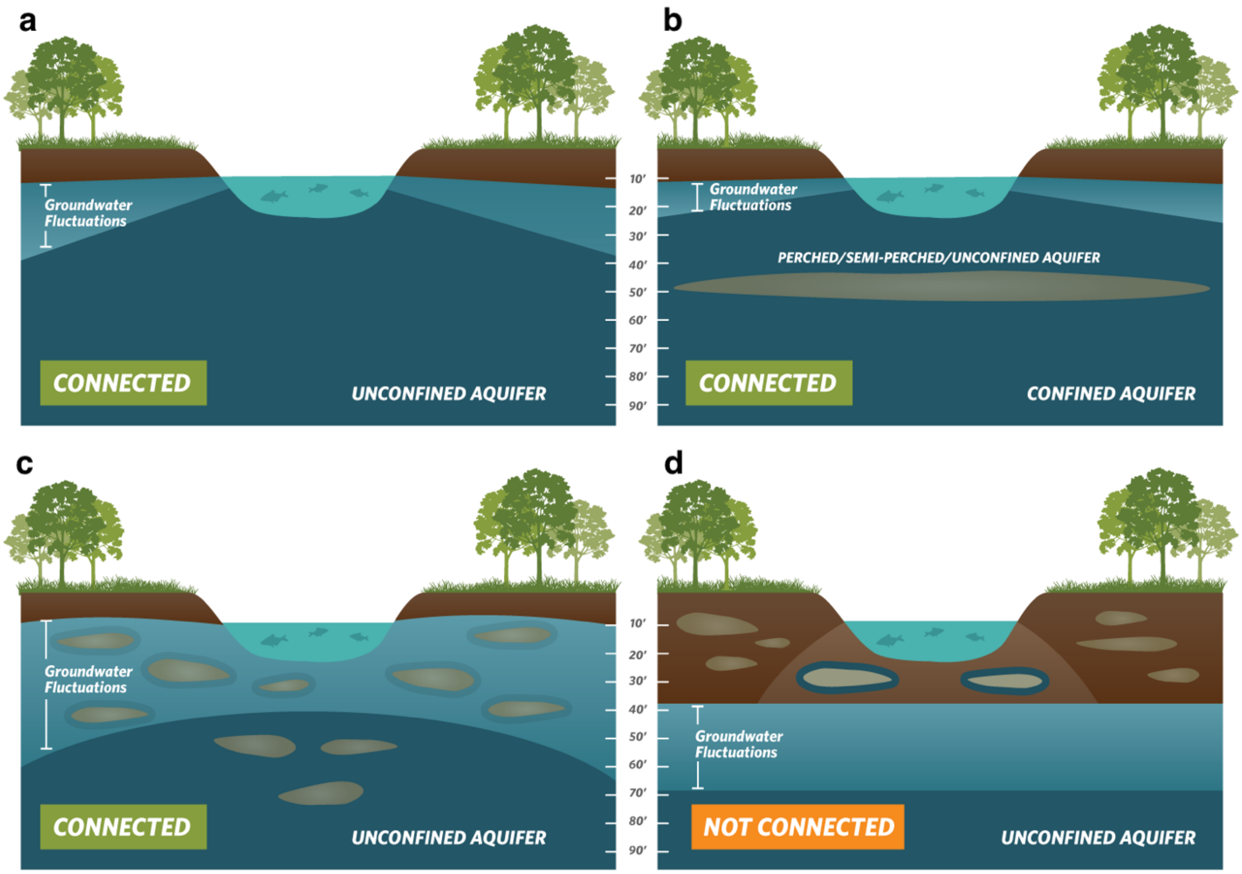

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

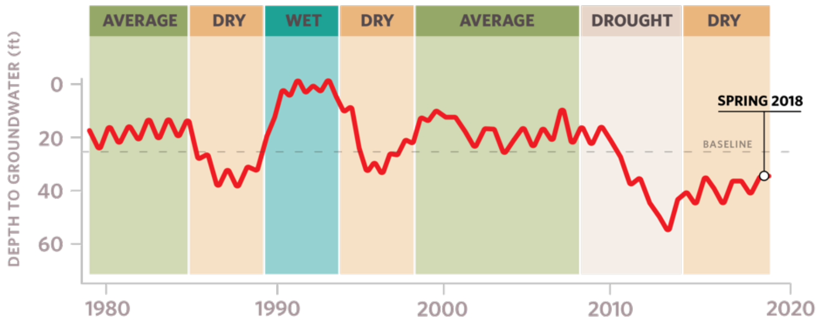

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

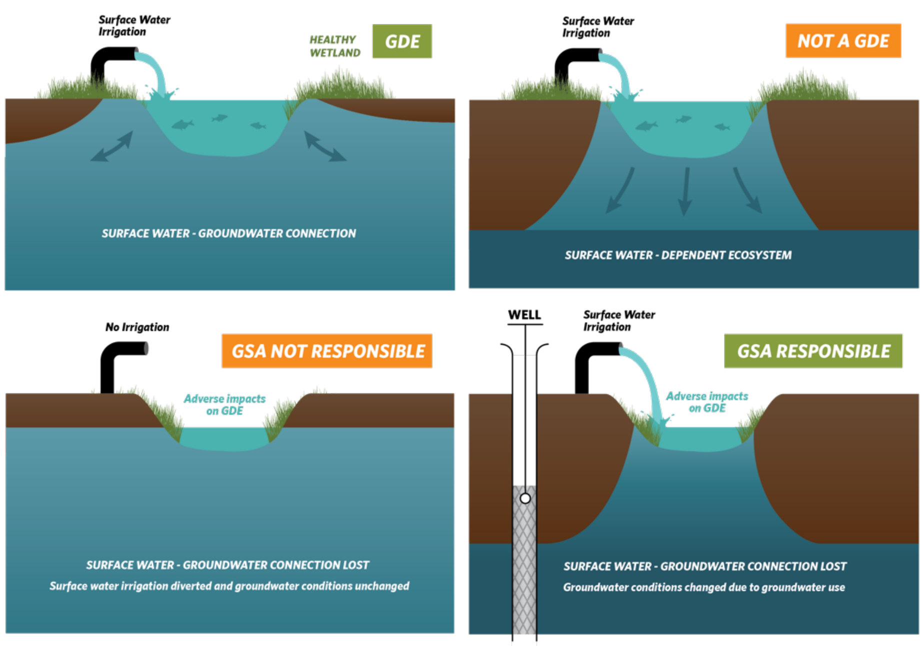

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

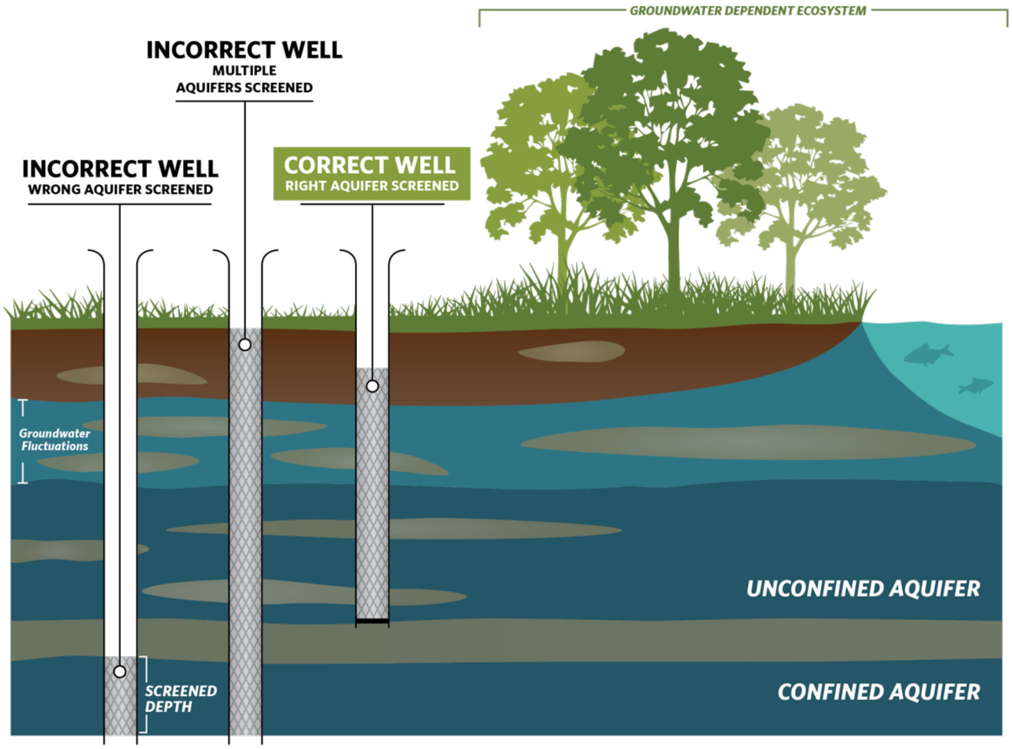

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

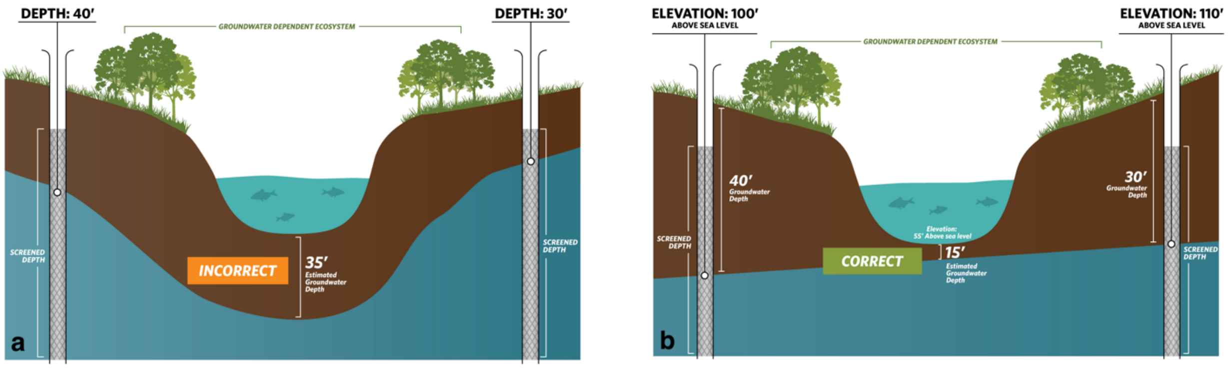

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

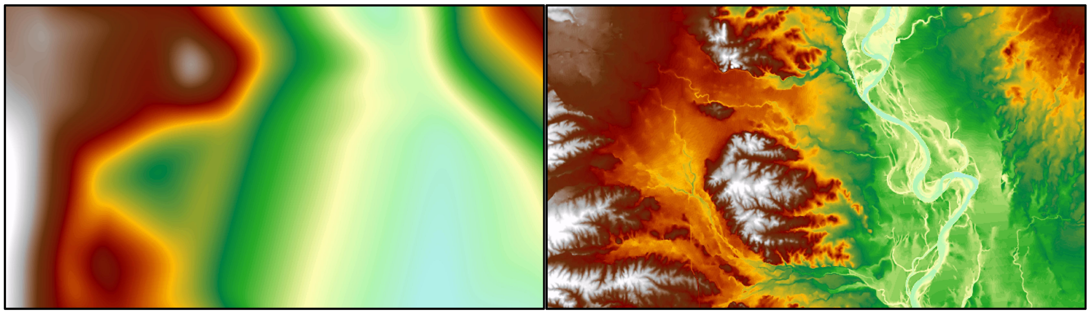

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

September 26, 2021

Siskiyou County Flood Control and Water Conservation District
1312 Fairlane Road
Yreka, CA 96097

Submitted via email: lauraf@lwa.com; katie.duncan@stantec.com; sgma@co.siskiyou.ca.us

Re: Public Comment Letter for Scott River Valley Draft Groundwater Sustainability Plan

Dear Laura Foglia,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Scott River Valley Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.

2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Scott River Valley Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Scott River Valley Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. We note the following deficiencies with the identification of these key beneficial users.

- The GSP states that there are three DACs in the basin, but these areas are not mapped.
- The GSP provides a map of domestic well density in Figure 5, but fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the basin.
- The GSP fails to identify the population dependent on groundwater as their source of drinking water in the basin. Specifics are not provided on how much each DAC community relies on a particular water supply (e.g., what percentage is supplied by groundwater).

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS
• Provide a map of the DACs in the basin. The DWR DAC mapping tool[1] can be used for this purpose. • Include a map showing domestic well locations and average well depth across the basin. • Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

[1] The DWR DAC mapping tool is available online at: https://gis.water.ca.gov/app/dacs/

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. Based on the ISW section of the GSP (Section 2.2.1.7), it appears that a comprehensive analysis of ISWs in the basin was performed using the Scott Valley Integrated Hydrologic Model. However, little information is provided in the GSP to support the conclusions presented. The GSP states that data from 1990-2018 was used for the analysis, but there is no description of the location of groundwater wells or stream gauges used in analysis, or description of temporal (seasonal and interannual) variability of the data.

The GSP concludes (p. 2-74): “Across the stream system in Scott Valley (Fig. 18), there are no known stream reaches that are flowing and also entirely and permanently disconnected from surface water, separated from the water table by thick unsaturated zones. For purposes of this plan, the Scott River and its major tributaries (Mill, Shackleford, Oro Fino, Moffett, Kidder, Patterson, Crystal, Johnson, Etna, French, Miners, Sugar, and Wildcat Creeks, South Fork and East Fork Scott River, Figure 15) are therefore all considered part of a single interconnected surface water system in the basin.” The map of stream reaches (Figure 18), however, is not consistent with description in the text, and the legend labels (dry, wet, uncertain - no, uncertain - yes) are not explained.

RECOMMENDATIONS
● Describe the legend labels (i.e., dry, wet, uncertain - no, uncertain - yes) used on Figure 18, and contextualize with losing and gaining terminology ● Further describe the groundwater elevation data and stream flow data used in the analysis. Ensure depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) are used to determine the range of depth and capture the variability in environmental conditions inherent in California’s climate. ● Overlay the stream reaches shown on Figure 18 with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis. ● For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. ● Describe data gaps for the ISW analysis in the ISW section, in addition to the discussion in Appendix 3-A (Data Gap Assessment). Discuss and reconcile these data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of comprehensive, systematic analysis of the basin's GDEs.

The GSP states (p. 2-76) that the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) was used as a starting point. "These datasets were evaluated against groundwater depth data, local expertise, and satellite imagery and categorized to produce the maps in Figure 19." We commend the GSA for starting with the NC dataset and using additional sources to identify GDEs in the basin.

Further description in the GSP, however, of the GDE analysis process is very sparse, except to state that the presence and geographic extent of groundwater dependent vegetation were verified through an evaluation by the ad hoc committee. The GSP does not discuss how the NC dataset was verified with the use of groundwater data from the shallow aquifer. Without an analysis of groundwater data to verify the NC dataset polygons, it will be difficult or impossible to adequately monitor and manage the basin's GDEs throughout GSP implementation.

We commend the GSA for its comprehensive discussion of groundwater dependent species in the basin, including special status species. The GSP provides detailed description of freshwater species in the Scott River Valley basin and describes their habit and life cycle.

RECOMMENDATIONS

- Develop and describe a systematic approach for analyzing the basin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained, removed, or added to/from the NC dataset (include the removal reason if polygons are not considered potential GDEs, or include the data source if polygons are added). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30 feet threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as “Potential GDEs” in the GSP until data gaps are reconciled in the monitoring network.

Native Vegetation and Managed Wetlands
Native vegetation and managed wetlands are water use sectors that are required[2,3] to be included into the water budget. The integration of native vegetation into the water budget is **insufficient**. The GSP describes the soil water budget model (SWBM) which computes groundwater needs and evapotranspiration of crops and native vegetation. The water budget did not explicitly include the current, historical, and projected demands of native vegetation, but instead lumped all evapotranspiration together. Only the current water budget was presented in the GSP.

The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.
- State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development
Stakeholder engagement during GSP development is **insufficient**. SGMA’s requirement for public notice and engagement of stakeholders[4] is not fully met by the description in the Stakeholder Communication and Engagement Plan included in the GSP (Appendix 1-A).

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[2] “’Water use sector’ refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation.” [23 CCR §351(al)]
[3] “The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.” [23 CCR §354.18]
[4] “A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin.” [23 CCR §354.10(d)(3)]

The GSP describes outreach to tribal and environmental stakeholders in the basin and states that members of these groups are on the Stakeholder Advisory Committee. However, we note the following deficiencies with other aspects of the stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms. They include attendance at public meetings, stakeholder email list, and updates to the GSP website. There is no specific outreach described for members of the DAC communities or domestic well owners.

- The Stakeholder Communication and Engagement Plan does not include a plan for continual opportunities for engagement through the *implementation* phase of the GSP for DACs and domestic well owners.

RECOMMENDATION
• In the Stakeholder Communication and Engagement Plan, describe active and targeted outreach to engage DAC members and domestic well owners throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[5] and establishing minimum thresholds.[6,7]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP does not sufficiently describe or analyze direct or indirect impacts on domestic drinking water wells, DACs, or tribes when defining undesirable results. The GSP does not sufficiently describe how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results in the basin.

For degraded water quality, SMC were developed for two of the constituents of concern (COCs) in the basin, nitrate and specific conductivity. Minimum thresholds were set at the primary and secondary maximum contaminant levels (MCLs), respectively, for these COCs. The GSP states (p. 3-42): "Although benzene is identified as a potential constituent of concern in Section 2.2.3, no SMC is defined for benzene as current benzene data are associated with leaking underground storage tanks (LUST) where the source of benzene is known and monitoring and remediation are

[5] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
[6] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[7] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

in progress." However, SMC should be established for all COCs in the basin, in addition to coordinating with water quality regulatory programs.

The GSP only includes a very general discussion of indirect impacts to drinking water users when defining undesirable results and evaluating the cumulative or indirect impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs or tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs or tribes.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when describing undesirable results for chronic lowering of groundwater levels.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs, drinking water users, and tribes within the basin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.

Degraded Water Quality

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[8]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs, drinking water users, and tribes.

- Set minimum thresholds and measurable objectives for benzene. Ensure they align with drinking water standards[9].

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP sets minimum thresholds to historic groundwater lows, with a buffer that further lowers the elevations. The GSP states (p. 3-35): "The minimum threshold (MinT) is set at the historic maximum depth to water measurement (i.e., the historic low measured groundwater elevation), plus a buffer to allow for operational flexibility against the measurable objective under extreme climate conditions and to accommodate practicable triggers. The buffer is either 10% of the historic maximum depth to water measurement, or 10 feet, whichever is smaller." However, the impacts to GDEs under this scenario are not discussed in the GSP. If minimum thresholds are set to historic low groundwater levels (or lower) and the basin is allowed to operate at or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that

[8] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[9] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

are more adverse than what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse. SGMA requires that SMCs, and specifically minimum thresholds, be established in consideration of beneficial users[10-12], thus using historic maximum groundwater levels as a proxy for 'significant and unreasonable' is inadequate since it fails to take beneficial user water needs into consideration.

The GSP includes a comprehensive discussion of the depletion of interconnected surface water SMC and the challenges surrounding setting the SMC due to an adjudicated area in the basin. The GSP states (p. 3-59): "To summarize, the ISW Undesirable Result is narrower in scope than the overall low flow challenges in the Scott River stream network and is defined as "significant and unreasonable stream depletion due to groundwater extraction from wells subject to SGMA (i.e., outside of the Adjudicated Zone)." The GSP further states (p. 3-61): "The minimum threshold is any portfolio of PMAs that achieves an individual monthly stream depletion reversal similar to, but not necessarily identical to, the stream depletion reversal achieved by the specific MAR-ILR [Managed Aquifer Recharge-In Lieu Recharge] scenario presented to the Advisory Committee." Despite the complexities of managing ISW in the basin, the GSP does not attempt to evaluate the cumulative or indirect impacts of the proposed minimum thresholds for ISW on environmental beneficial users of surface water. The method of setting the SMC based on project and management actions in the basin is not correct, as the SMC should inform the design and implementation of project and management actions (i.e., project and management actions should help avoid undesirable results), not the other way around.

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[10] in the basin. Defining undesirable results is the crucial first step before the minimum thresholds[11] can be determined.

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when defining minimum thresholds in the basin[12]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial

[10] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[11] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[12] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

users that are already protected under pre-existing state or federal law[6,13]. For example, model streamflow depletion due to pumping outside adjudicated areas to determine how much streamflow depletion is permissible given the amount of depletion that has already occurred in the past. The SMC should reflect how much more depletion is likely to be permissible based on future drier climatic conditions.

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[14] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. Please make available the detailed water budget, referenced as Appendix 2-C, so that the incorporation of climate change into the water budget can be fully reviewed. The following comments were prepared based on information included in the GSP main text.

The GSP does incorporate climate change into the projected water budget using DWR change factors for 2030 and 2070. The GSP also considers multiple climate scenarios (e.g., the 2070 moderately wet and extremely dry climate scenarios) in the projected water budget. The GSP includes climate change into key inputs (e.g., precipitation, evaporation, and surface water flow) of the projected water budget.

However, the GSP does not calculate a sustainable yield based on the projected water budget with climate change incorporated, but instead states that the sustainable yield will vary over time as new project and management actions are added. The GSP states (p. 2-131): “Since these reductions in groundwater pumping will vary over time and will be a function of the PMAs that will be implemented, the sustainable yield will vary over time as new PMAs are added.” Furthermore, the GSP states: “For every implementation of a PMA resulting in the reduction in groundwater pumping, including some conservation easements, there is a commensurate downward adjustment in sustainable yield. The exact amount of that adjustment varies over time and will depend on the future portfolio of PMAs implemented (see chapters 3 and 4). Without the automatic adjustment of the sustainable yield to future agreed-upon reductions in groundwater pumping, other water users in the Basin may claim that the reduction in groundwater pumping, e.g., for in lieu recharge, makes groundwater available for pumping elsewhere or at other times, up to the (constant) limit of the sustainable yield. This must be avoided to successfully manage the basin.” Keep in mind that sustainable yield is a legally required component of SGMA and necessary for informing what project and management actions are necessary in the basin. If sustainable yield is not calculated, then there is also increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not explicitly calculate sustainable yield may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, domestic well owners, and tribes.

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[13] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California’s threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[14] “Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow.” [23 CCR §354.18(e)]

RECOMMENDATIONS

- Include the water budget appendix in the GSP, so that the manner in which climate change is incorporated into the water budgets is fully explained.
- Estimate sustainable yield based on the projected water budget with climate change incorporated, to inform the basis for development of projects and management actions.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, and GDEs. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[15].

The GSP includes a data gap assessment (Appendix 3-A) that identifies and prioritizes data gaps in the monitoring networks. Thus while the GSP recognizes the importance of filling data gaps, it does not provide specific plans, well locations shown on a map, or a timeline to fill the data gaps. The GSP states (p. 3-7): "These additional monitoring or information requirements depend on future availability of funding and are not yet considered among the GSP Representative Monitoring Points (RMPs). They will be considered as potential RMPs and may eventually become part of the GSP network at the 5-year GSP update." However, the additional RMPs should be included in the GSP now, instead of delaying inclusion until the 5-year GSP update. Without a map of proposed new monitoring well locations, a determination cannot be made regarding the adequacy of the monitoring network for sustainability indicators going forward into the GSP implementation phase. Regarding the frequency of groundwater quality monitoring, the plan states that nitrate will be monitored annually while specific conductivity will be monitored periodically. This monitoring plan is insufficient to adequately capture groundwater quality conditions within the basin.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify potentially impacted areas. Increase the number of representative monitoring points (RMPs) across the basin as needed to adequately monitor all groundwater condition indicators. Prioritize proximity to GDEs and drinking water users when identifying new RMPs.
- Provide specific plans to fill data gaps in the monitoring network. Evaluate how the gathered data will be used to identify and map GDEs, and identify DACs and shallow domestic well users that are vulnerable to undesirable results.

[15] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to beneficial users of groundwater such as DACs and drinking water users.

We commend the GSA for including projects and management actions with explicit benefits to the environment (e.g., Scott River Water Trust Leasing Program, Beaver Dam Analogues, and East Fork Scott Project). The GSP discusses how these projects will benefit ecosystems, but does not discuss the manner in which DACs, drinking water users, and tribes may be benefitted or impacted by projects and management actions identified in the GSP. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

RECOMMENDATIONS

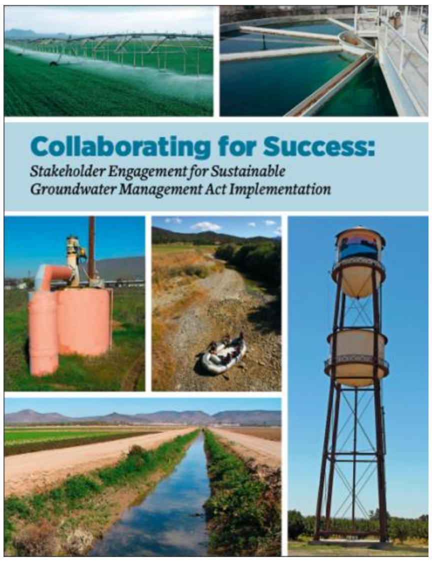
- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.
- For DACs, domestic well owners, and tribes, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.
- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[16].
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[16] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



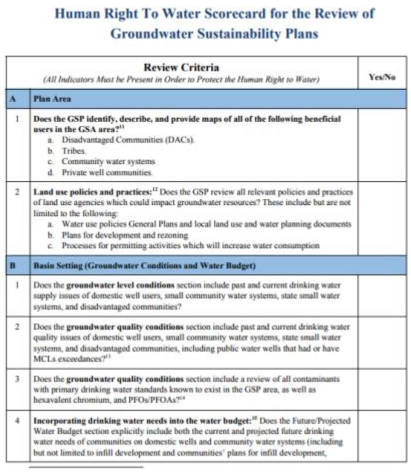
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

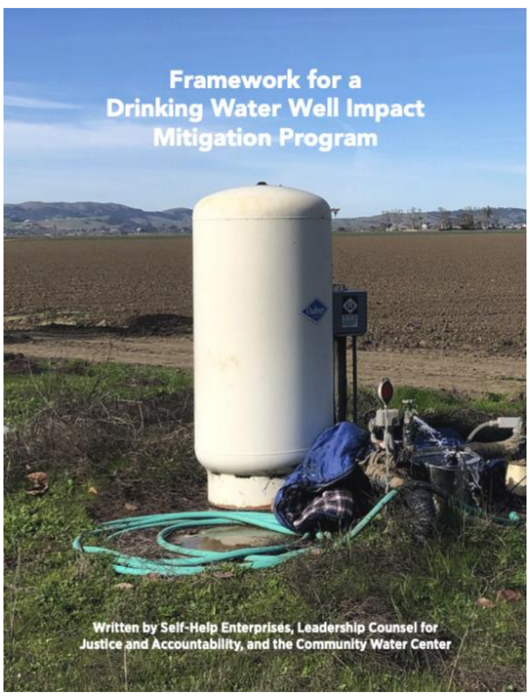


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

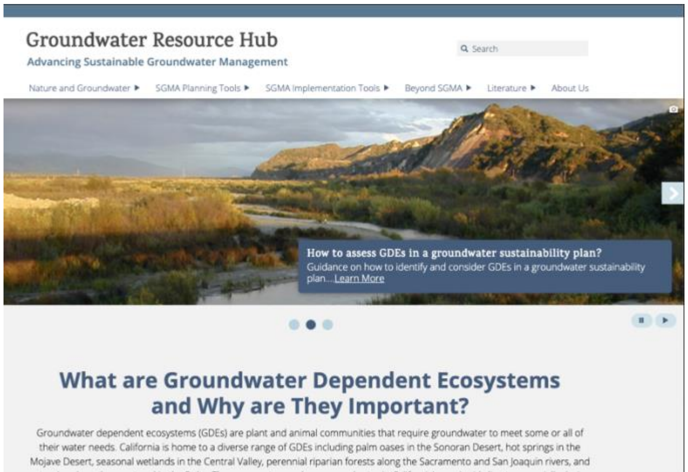
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



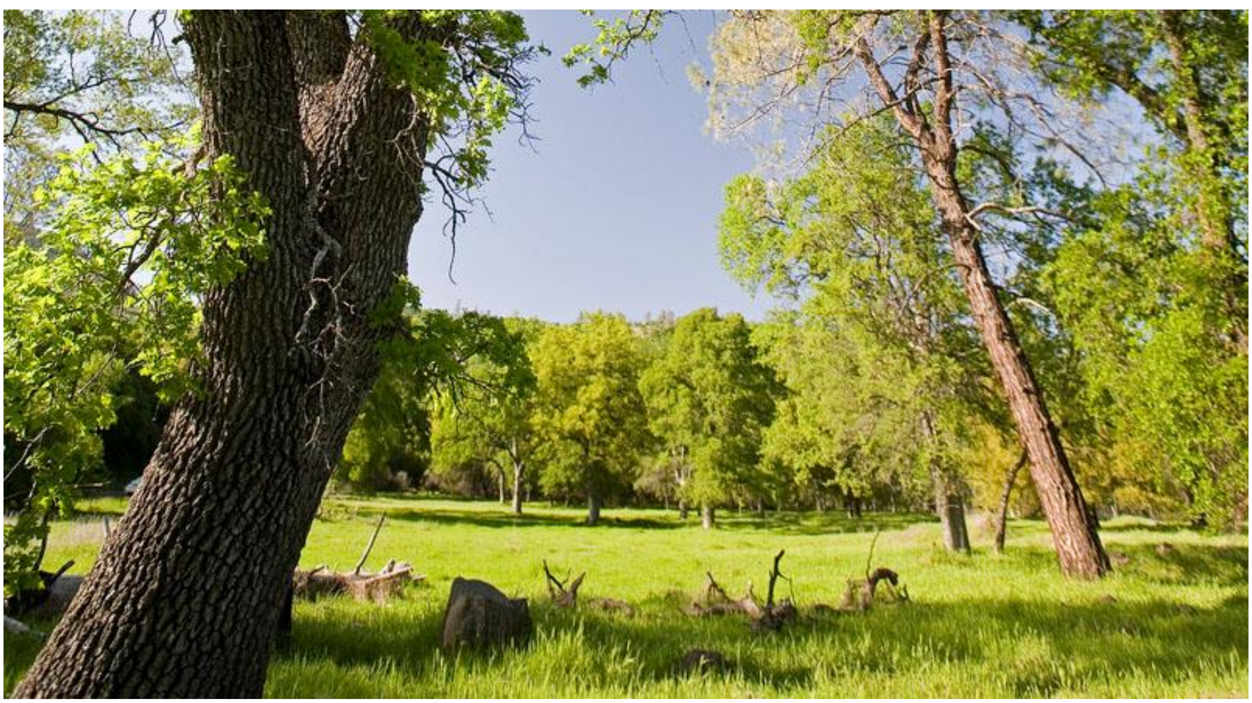
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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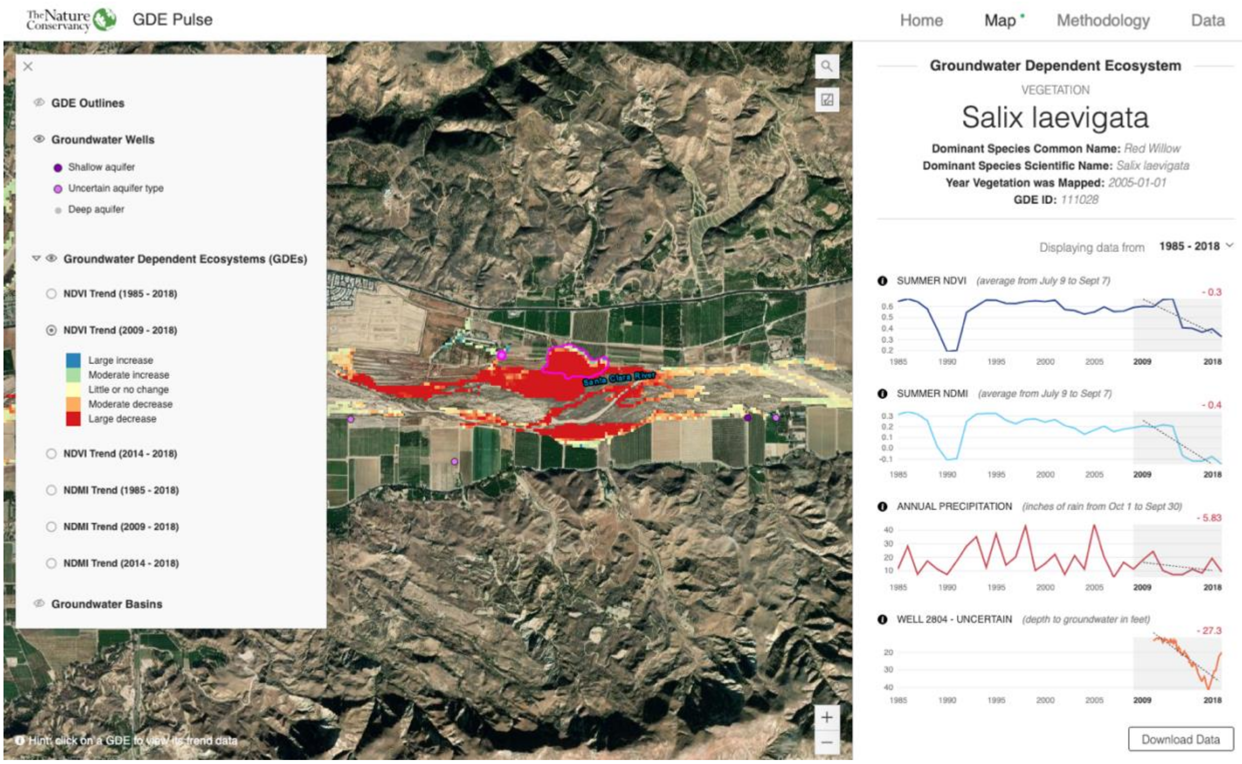
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

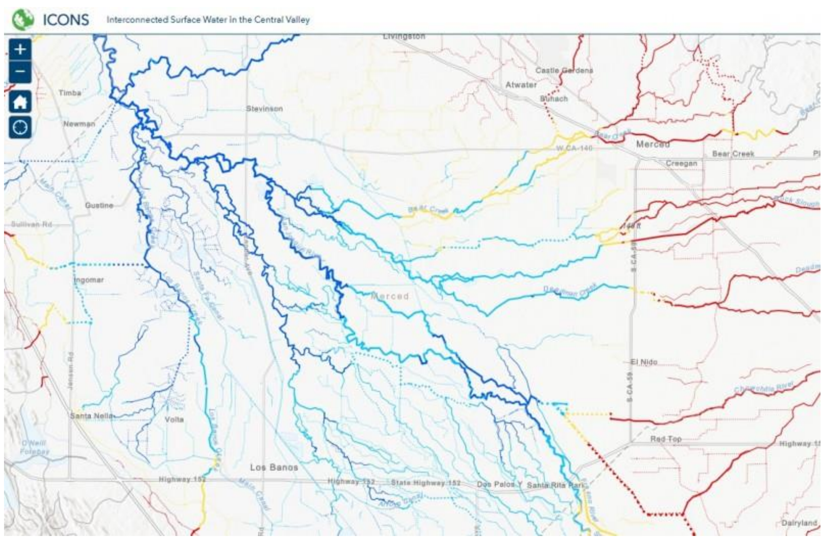
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Scott River Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Scott River Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas platyrhynchos	Mallard			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Butorides virescens	Green Heron			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Phalaropus tricolor	Wilson's Phalarope			
Pluvialis squatarola	Black-bellied Plover			
Podilymbus podiceps	Pied-billed Grebe			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
CRUSTACEANS				
Stygobromus mysticus	A Cave Obligate Amphipod		Special	
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Ascaphus truei	Coastal Tailed Frog			
Dicamptodon tenebrosus	Pacific Giant Salamander			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Leucorrhinia intacta	Dot-tailed Whiteface			
Fallceon thermophilos	A Mayfly			
Sweltsa salix	A Stonefly			Not on any status lists
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists

Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
Sorex palustris	American Water Shrew			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Gonidea angulata	Western Ridged Mussel		Special	
Margaritifera falcata	Western Pearlshell		Special	
PLANTS				
Alnus rhombifolia	White Alder			
Beckmannia syzigachne	American Sloughgrass			
Bidens cernua	Nodding Beggarticks			
Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche palustris	Vernal Water-starwort			
Carex nebrascensis	Nebraska Sedge			
Carex nudata	Torrent Sedge			
Carex stipata stipata	Stalk-grain Sedge			
Castilleja miniata miniata	Greater Red Indian-paintbrush			
Cicuta douglasii	Western Water-hemlock			
Cirsium scariosum scariosum	Drummond's Thistle			Not on any status lists
Cyperus squarrosus	Awned Cyperus			
Eleocharis bella	Delicate Spikerush			
Eleocharis obtusa	Blunt Spikerush			
Helenium autumnale	Common Sneezeweed			
Lilium pardalinum pardalinum	Leopard Lily			
Lupinus polyphyllus polyphyllus	Bigleaf Lupine			
Mimulus guttatus	Common Large Monkeyflower			
Navarretia intertexta	Needleleaf Navarretia			
Perideridia howellii	Howell's False Caraway			
Persicaria lapathifolia				Not on any status lists
Potamogeton foliosus foliosus	Leafy Pondweed			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rumex conglomeratus	NA			
Rumex salicifolius salicifolius	Willow Dock			
Salix exigua exigua	Narrowleaf Willow			
Salix laevigata	Polished Willow			

Salix lasiandra lasiandra				Not on any status lists
Sidalcea oregana oregana	Oregon Checker-mallow			
Solidago elongata				Not on any status lists
Veronica americana	American Speedwell			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

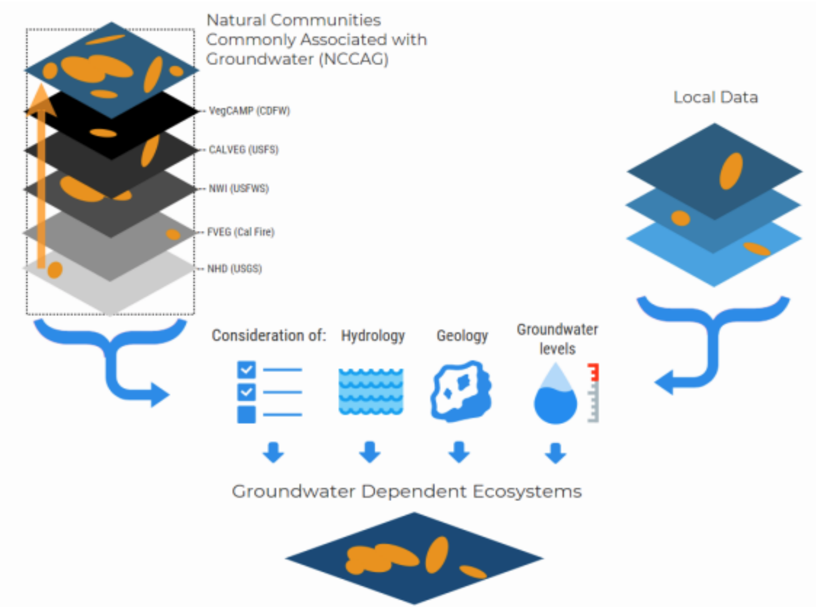


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

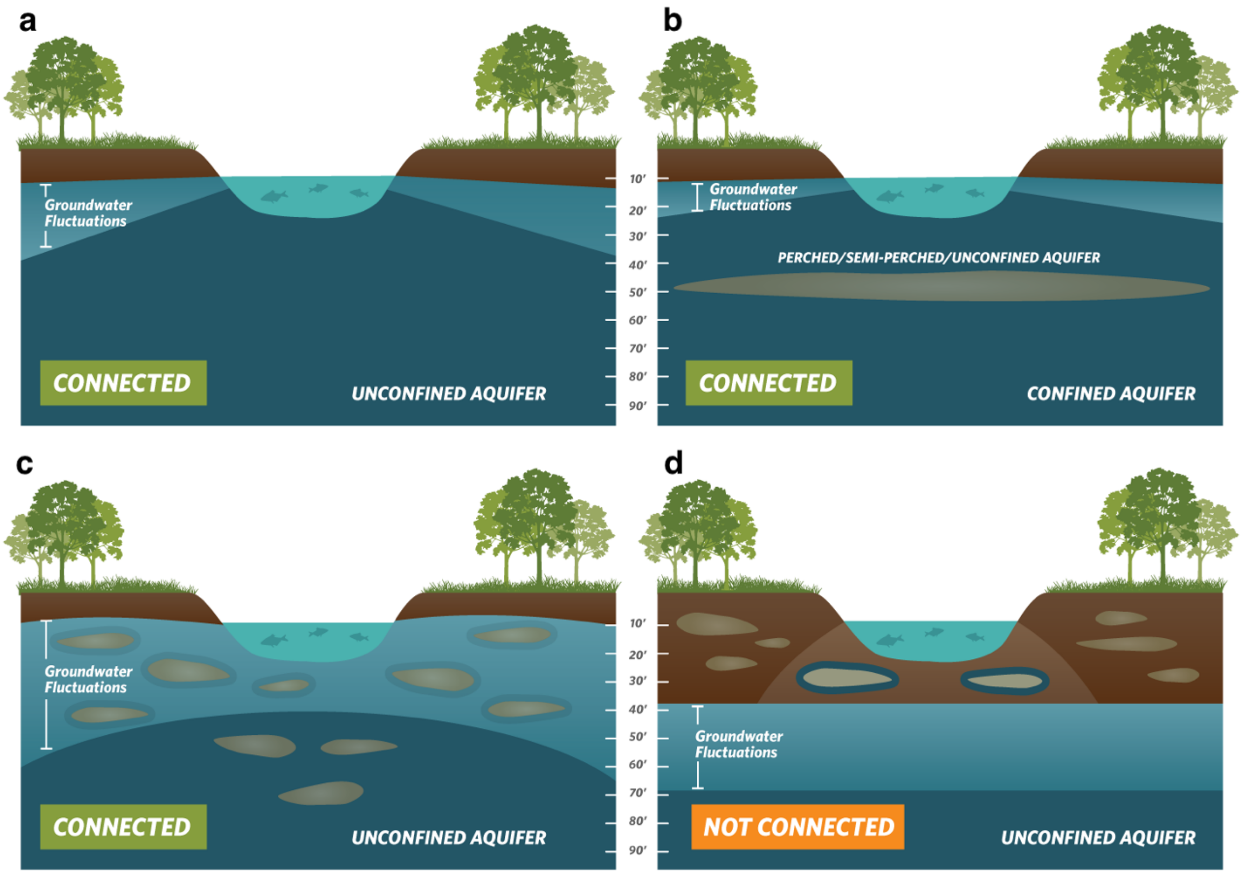

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

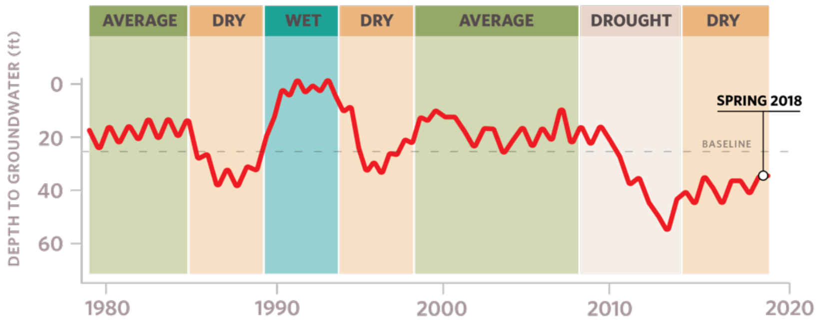

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

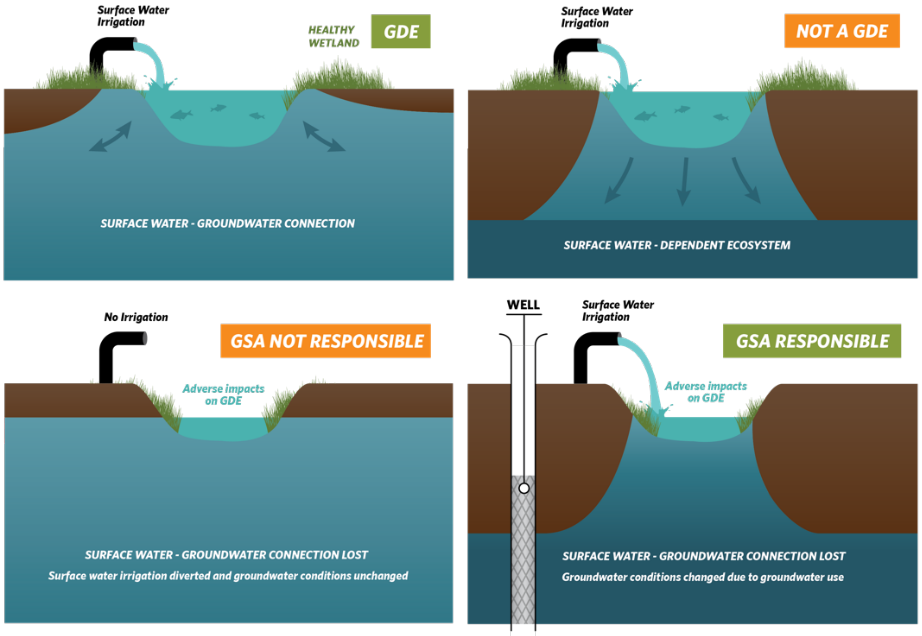

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

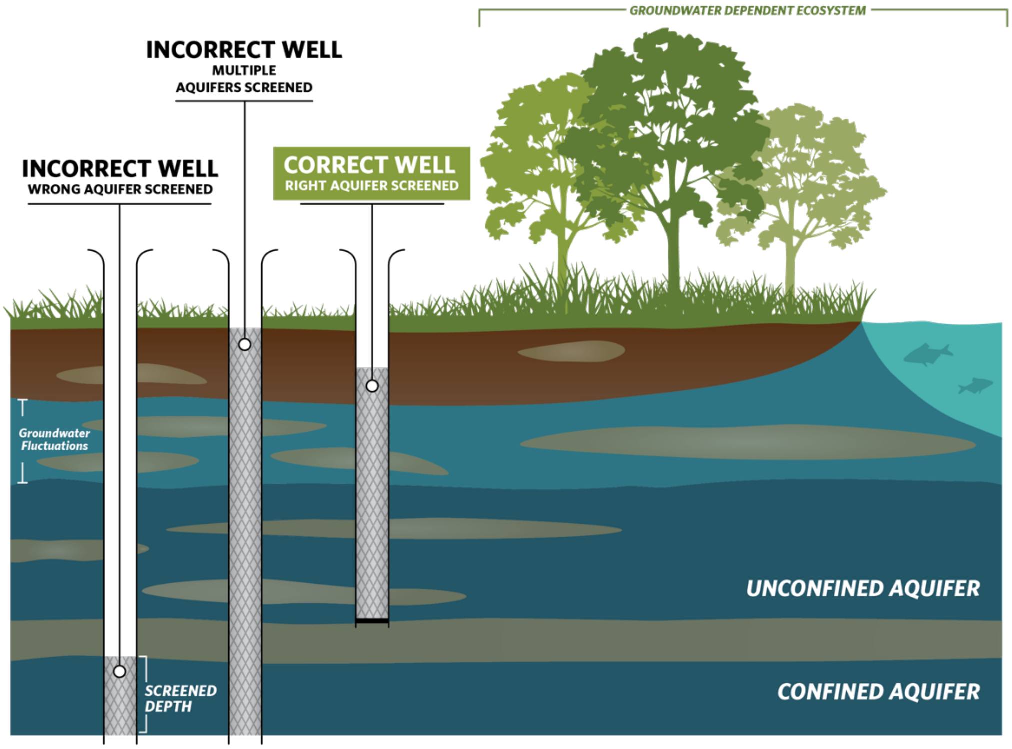

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

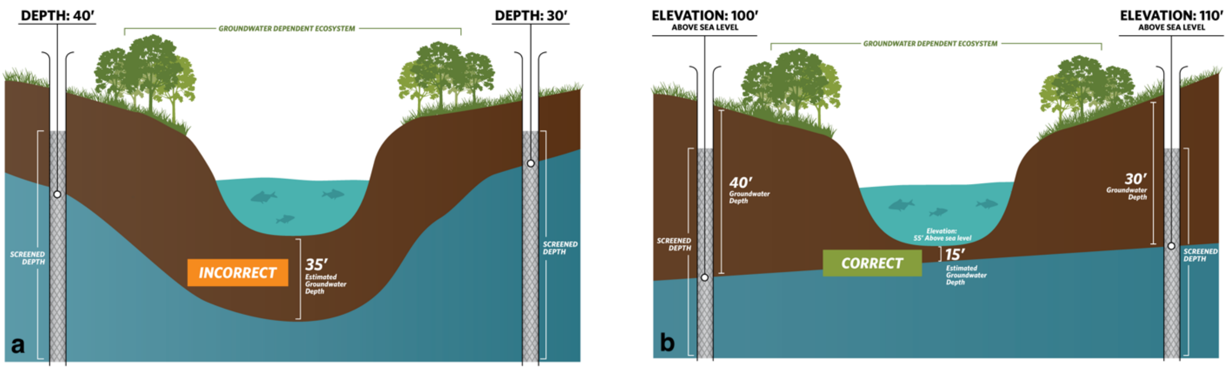

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

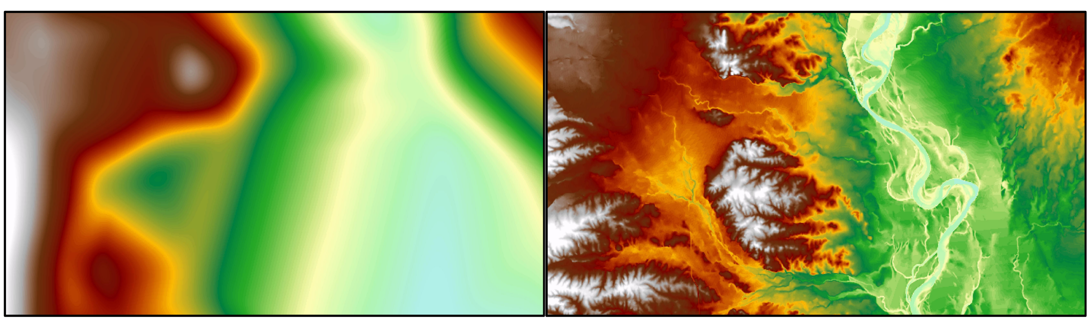

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

September 26, 2021

Siskiyou County Flood Control and Water Conservation District
1312 Fairlane Road
Yreka, CA 96097

Submitted via email: lauraf@lwa.com; katie.duncan@stantec.com; sgma@co.siskiyou.ca.us

Re: Public Comment Letter for Shasta Valley Draft Groundwater Sustainability Plan

Dear Laura Foglia,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Shasta Valley Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Shasta Valley Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Shasta Valley Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. We note the following deficiencies with the identification of these key beneficial users.

- The GSP states that there are five DACs in the basin, but these areas are not mapped and the population is not provided.
- The GSP provides a map of domestic well density in Figure 4, but fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the basin.
- The GSP fails to identify the population dependent on groundwater as their source of drinking water in the basin. Specifics are not provided on how much each DAC community relies on a particular water supply (e.g., what percentage is supplied by groundwater).

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS
• Provide a map of the DACs in the basin. The DWR DAC mapping tool[1] can be used for this purpose. Include the population of each DAC in the GSP text or on the map. • Include a map showing domestic well locations and average well depth across the basin. • Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

[1] The DWR DAC mapping tool is available online at: https://gis.water.ca.gov/app/dacs/

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. To assess ISWs, the plan relied on previous reports by Shasta Valley Resource Conservation District (SVRCD) and an on-going transect study for the Little Shasta River and Shasta River to determine the direction of flow exchange. The transect study commenced in May 2020.

The GSP states (p. 2-105): "The Shasta River and its major tributaries are all considered part of the interconnected surface water system in the Basin." Figure 43 maps streams in the basin, but only shows Shasta River and Little Shasta River as being interconnected. No other data is presented in this section of the GSP, including depth-to-groundwater data and well locations.

RECOMMENDATIONS
● Describe available groundwater elevation data and stream flow data in the basin. ISWs are best analyzed using depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought), to determine the range of depth and capture the variability in environmental conditions inherent in California's climate. ● Overlay the stream reaches shown on Figure 43 with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells in the basin. ● For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. ● On the stream reaches map (Figure 43), consider any segments with data gaps as potential ISWs and clearly mark them as such on the map. ● Describe data gaps for the ISW analysis. Reconcile these data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to lack of clarity around the monitoring well data (well location and screen depth) used to map groundwater elevations and depth to groundwater. The GSP references TNC Best Practices for using the NC Dataset (2019) as the approach used to map depth to groundwater, using the difference between land surface elevation and interpolated groundwater elevation above mean sea level. However, the GSP does not further describe the monitoring well data (well location and screen depth) used to create the depth-to-groundwater maps presented in Appendix 2-H.

The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources. However, we found that some mapped features in the NC dataset were improperly disregarded, as described below.

- NC dataset polygons were incorrectly removed in areas adjacent to irrigated fields due to the presence of surface water. However, this removal criteria is flawed since GDEs, in addition to groundwater, can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields – simultaneously and at different temporal/spatial scales. NC dataset polygons adjacent to irrigated land can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to irrigated fields.

- NC dataset polygons were incorrectly removed based on the amount of time that they access groundwater. As presented in the GSP, assumed GDEs have access to groundwater >50% of time and assumed non-GDEs have access to groundwater <50% of the time. However, NC dataset polygons should not be assumed to be disconnected if there is any connection to groundwater (regardless of temporal percentage). Many GDEs often simultaneously rely on multiple sources of water (i.e., both groundwater and surface water), or shift their reliance on different sources on an interannual or inter-seasonal basis.

RECOMMENDATIONS

- On the depth-to-groundwater level maps presented in Appendix 2-H, include the location of groundwater monitoring wells used to produce the maps. Discuss screening depth of monitoring wells and ensure they are monitoring the shallow principal aquifer. Change the vertical scale such that shallow groundwater elevations are presented more clearly. For example, change the largest depth on the scale to a depth of 100 or 200 feet (instead of 3000 feet). The manner in which the depths are presented make it very difficult to distinguish between depths ranging from 0-100 feet, which is the depth range pertinent to GDEs.

- Use depth-to-groundwater data from multiple seasons and water year types to verify whether polygons in the NC Dataset are supported by groundwater, instead of the incorrect criteria mentioned above (presence of irrigation water or less than 50% time connected to groundwater). Instead of using groundwater elevation data from 2011 - 2020, we recommend the pre-SGMA baseline period of 2005 - 2015.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as “Potential GDEs” in the GSP until data gaps are reconciled in the monitoring network.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[2,3] to be included into the water budget. The integration of native vegetation into the water budget is **insufficient**. The water budget did not explicitly include the current, historical, and projected demands of native

[2] “’Water use sector’ refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation.” [23 CCR §351(al)]

[3] “The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.” [23 CCR §354.18]

vegetation. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.
- State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders[4] is not fully met by the description in the Stakeholder Communication and Engagement Plan included in the GSP (Appendix 1-A).

The GSP describes outreach to tribal and environmental stakeholders in the basin and states that members of these groups are on the Stakeholder Advisory Committee. However, we note the following deficiencies with other aspects of the stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms. They include attendance at public meetings, stakeholder email list, and updates to the GSP website. There is no specific outreach described for members of the DAC communities or domestic well owners.
- The Stakeholder Communication and Engagement Plan does not include a plan for continual opportunities for engagement through the *implementation* phase of the GSP for DACs, domestic well owners, and environmental stakeholders.

RECOMMENDATION

- In the Stakeholder Communication and Engagement Plan, describe active and targeted outreach to engage DAC members, domestic well owners, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[5] and establishing minimum thresholds.[6,7]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP does not sufficiently describe or analyze direct or indirect impacts on domestic drinking water wells, DACs, or tribes when defining undesirable results. The GSP does not sufficiently describe how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results in the basin.

For degraded water quality, minimum thresholds for two constituents of concern (COCs), nitrate and specific conductivity, are set at the maximum contaminant levels (MCLs). However, the GSP does not set SMC for the other COCs in the basin (benzene, arsenic, boron, iron, manganese, and pH). The GSP states on p. 3-49 that because benzene is already being monitored and managed by the Regional Board through the Leaking Underground Storage Tank (LUST) program, SMC are not needed. The GSP states that since arsenic, boron, iron, manganese, and pH are naturally occurring, SMC are not needed. However, SMC should be established for all COCs in the basin, in addition to coordinating with water quality regulatory programs. Naturally occurring COCs can be exacerbated as a result of groundwater use or groundwater management within the basin.

To determine undesirable results for water quality, the GSP performs a statistical analysis that describes the undesirable result as follows (p. 3-50): "This quantitative measure assures that water quality remains constant and does not increase by more than 15% per year, on average over ten years, in more than 25% of wells in the monitoring network. It also assures that water quality does not exceed maximum thresholds for concentration, MT, in more than 25% of wells in the monitoring network." The GSP does not, however, discuss impacts on drinking water users, DACs, or tribes when defining this undesirable result, such as describing how many domestic wells would be impacted by degraded water quality.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when describing undesirable results for chronic lowering of groundwater levels.
- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs, drinking water users, and tribes within the basin. Further describe

[5] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
[6] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[7] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.

Degraded Water Quality

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[8]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs, drinking water users, and tribes.

- Set minimum thresholds and measurable objectives for water quality constituents within the basin including naturally occurring constituents that can be exacerbated as a result of groundwater use or groundwater management. Ensure they align with drinking water standards[9].

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP states (p. 3-44): "Though SMCs for GDEs are not required by SGMA, the minimum thresholds for SV02 will be set to protect beneficial users such as GDEs and set at the Fall minimum." The GSP further states (p. 3-45): "Based on the 7 year history of data recorded in the CASGEM system for SV02, the MT for SV02 will be set at 31 feet below ground surface for the Fall measurement." The seven year period for which data is available is not provided in the GSP. Furthermore, the GSP does not discuss or analyze the potential impacts to GDEs based on the proposed minimum threshold. If minimum thresholds are set to historic low groundwater levels (or lower) and the basin is allowed to operate at or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse.

The minimum threshold for depletion of ISW is set to 100 cubic feet per second (cfs). The GSP states (p 3-45): "Based on the limited 5-year history of measurements for the groundwater contributions SMC, a preliminary Minimum Threshold will be set at 100 CFS of average monthly groundwater contributions." Based on discussion in the GSP, it is not clear how this value is derived and how it relates to beneficial users. Furthermore, the GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the basin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

[8] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[9] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[10] in the basin. Defining undesirable results is the crucial first step before the minimum thresholds[11] can be determined.

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when defining minimum thresholds in the basin[12]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,13].

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[14] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **incomplete**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2030 and 2070. The GSP also considers multiple climate scenarios (e.g., the 2070 moderately wet and extremely dry climate scenarios) in the projected water budget. The GSP includes climate change into key inputs (e.g., precipitation, evaporation, and surface water flow) of the projected water budget.

However, the GSP does not calculate a sustainable yield based on the projected water budget with climate change incorporated, but instead states that the sustainable yield will vary over time as new

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[10] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[11] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[12] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[13] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[14] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

project and management actions are added. The GSP states (p. 2-151): "The sustainable yield is not a number that is constant over time, as future conditions may decrease or increase the amount of groundwater that can be withdrawn without causing undesirable results." Furthermore, the GSP states: "For every implementation of a PMA resulting in the reduction in groundwater pumping, including some conservation easements, there is a commensurate downward adjustment in sustainable yield. The exact amount of that adjustment varies over time and will depend on the future portfolio of PMAs implemented (see chapters 3 and 4). Without the automatic adjustment of the sustainable yield to future agreed-upon reductions in groundwater pumping, other water users in the Basin may claim that the reduction in groundwater pumping, e.g., for in lieu recharge, makes groundwater available for pumping elsewhere or at other times, up to the (constant) limit of the sustainable yield. This must be avoided to successfully manage the basin." Keep in mind that sustainable yield is a legally required component of SGMA and necessary for informing what project and management actions are necessary in the basin. If sustainable yield is not calculated, then there is also increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not explicitly calculate sustainable yield may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, domestic well owners, and tribes.

RECOMMENDATIONS
● Estimate sustainable yield based on the projected water budget with climate change incorporated, to inform the basis for development of projects and management actions. ● Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, GDEs, and ISWs. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[15].

The GSP includes a data gap assessment (Appendix 3-A) that identifies and prioritizes data gaps in the monitoring networks. Thus while the GSP recognizes the importance of filling data gaps, it does not provide specific plans, well locations shown on a map, or a timeline to fill the data gaps. The GSP states (p. 3-7): "These additional monitoring or information requirements depend on future availability of funding and are not yet considered among the GSP Representative Monitoring Points (RMPs). They will be considered as potential RMPs and may eventually become part of the GSP network at the 5-year GSP update." However, the additional RMPs should be included in the GSP now, instead of included in the 5-year GSP update. Without a map of proposed new monitoring well locations, a determination cannot be made regarding the adequacy of the monitoring network for sustainability indicators going forward into the GSP implementation phase.

[15] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, GDEs, and ISWs to clearly identify potentially impacted areas. Increase the number of representative monitoring points (RMPs) across the basin as needed to adequately monitor all groundwater condition indicators. Prioritize proximity to GDEs and drinking water users when identifying new RMPs.

- Provide specific plans to fill data gaps in the monitoring network. Evaluate how the gathered data will be used to identify and map GDEs and ISWs, and identify DACs and shallow domestic well users that are vulnerable to undesirable results.

- Further describe the biological monitoring that will be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the basin. Appendix 3-A mentions the use of satellite images to evaluate the health of GDEs over time, however no further details are provided in the GSP.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to beneficial users of groundwater such as DACs and drinking water users.

We commend the GSA for including several projects and management actions with explicit benefits to the environment. The GSP discusses how these projects will benefit ecosystems, but does not discuss the manner in which DACs, drinking water users, and tribes may be benefitted or impacted by projects and management actions identified in the GSP. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs, domestic well owners, and tribes, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to

integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[16].

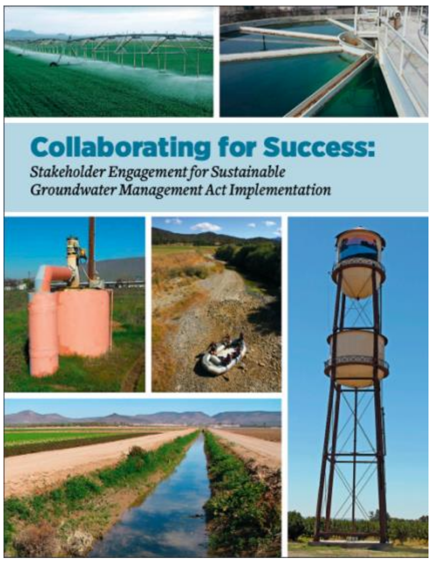
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[16] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

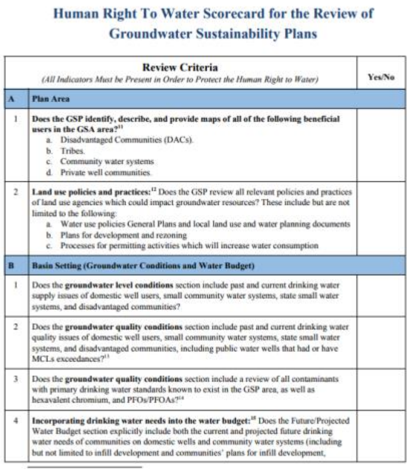
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

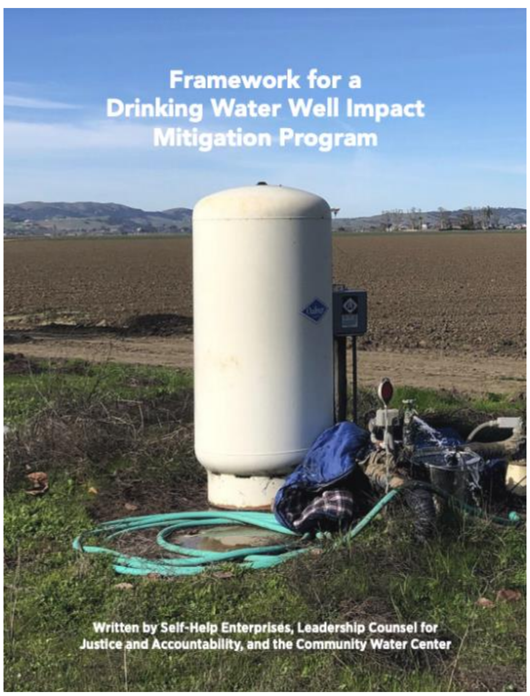


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria (All Indicators Must be Present in Order to Protect the Human Right to Water)	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

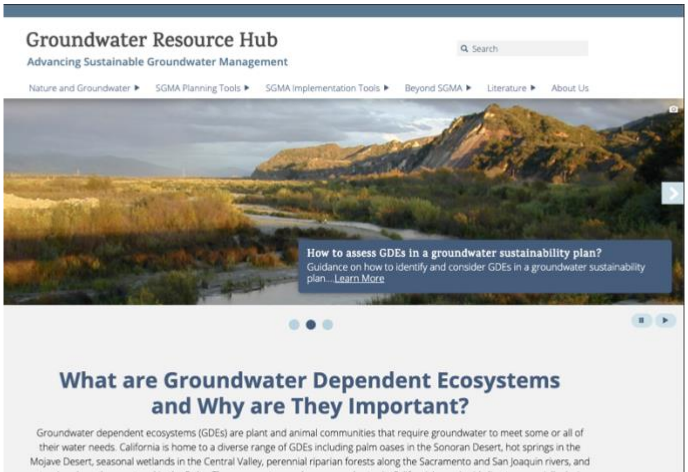
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



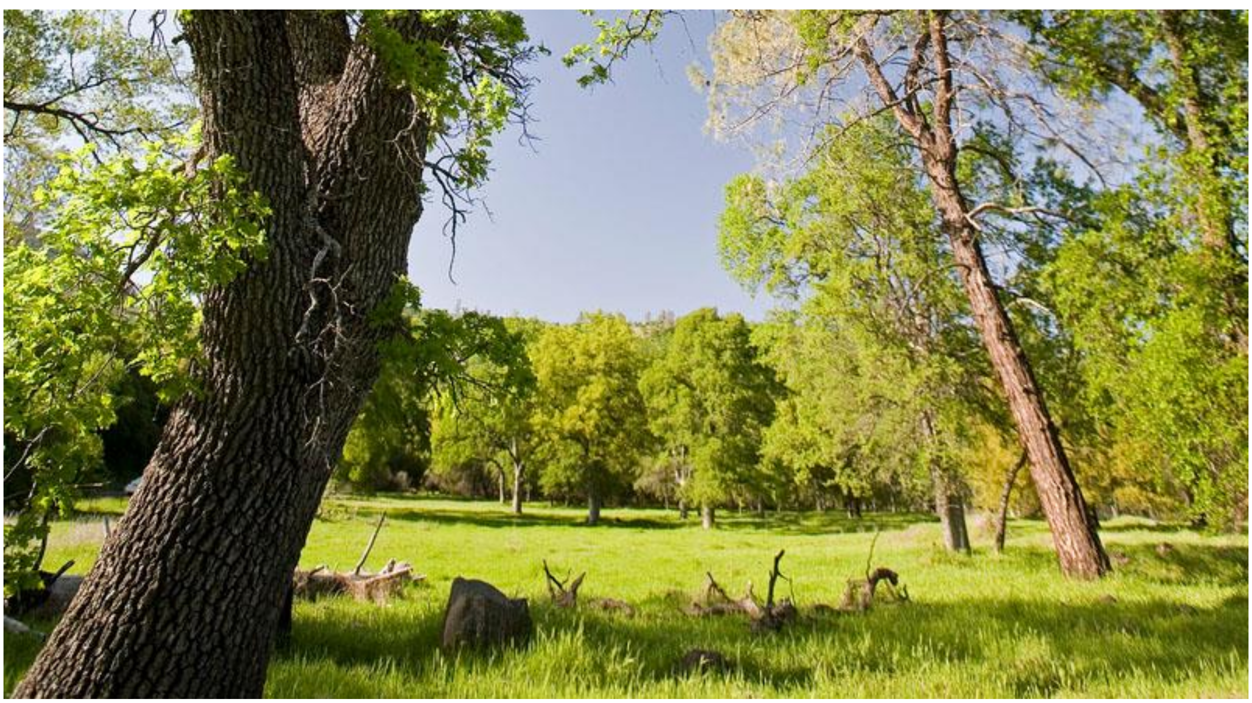
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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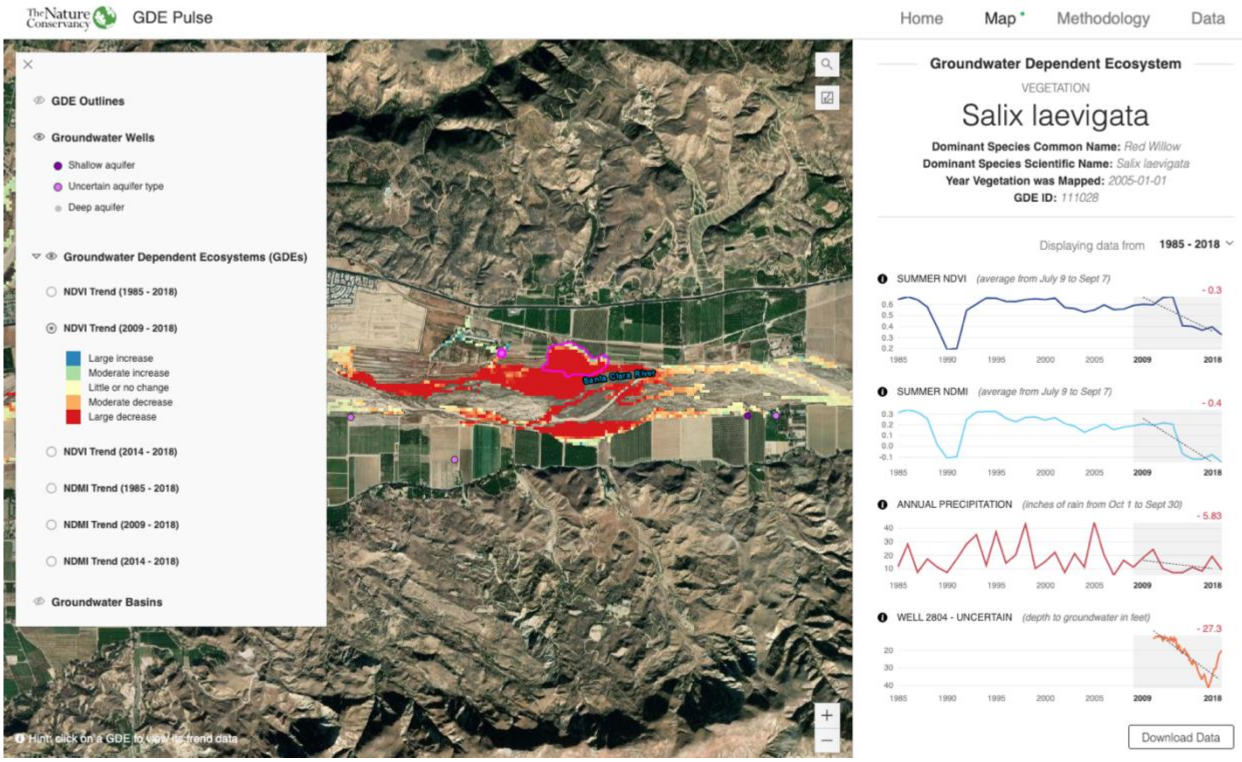
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

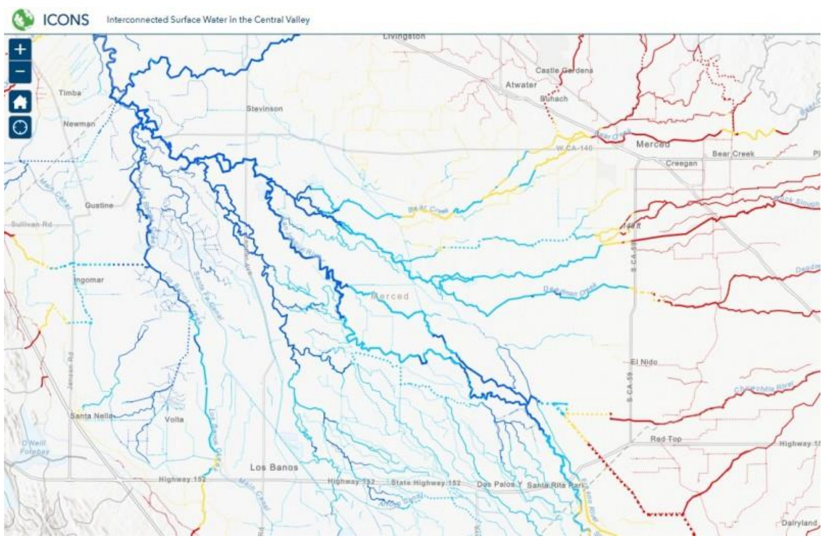
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Shasta Valley

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Shasta Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	**State**	**Other**
BIRDS				
Grus canadensis tabida	Greater Sandhill Crane		Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas americana	American Wigeon			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas platyrhynchos	Mallard			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya affinis	Lesser Scaup			
Aythya collaris	Ring-necked Duck			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala albeola	Bufflehead			
Bucephala albeola	Bufflehead			
Bucephala albeola	Bufflehead			
Butorides virescens	Green Heron			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Cinclus mexicanus	American Dipper			
Cinclus mexicanus	American Dipper			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Fulica americana	American Coot			
Fulica americana	American Coot			
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinago delicata	Wilson's Snipe			
Gallinago delicata	Wilson's Snipe			
Grus canadensis	Sandhill Crane			
Grus canadensis	Sandhill Crane			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			

Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus merganser	Common Merganser			
Oxyura jamaicensis	Ruddy Duck			
Oxyura jamaicensis	Ruddy Duck			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus boreas boreas	Boreal Toad			
Ascaphus truei	Coastal Tailed Frog			
Ascaphus truei	Coastal Tailed Frog			
Dicamptodon tenebrosus	Pacific Giant Salamander			
Dicamptodon tenebrosus	Pacific Giant Salamander			

Pseudacris regilla	Northern Pacific Chorus Frog			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana cascadae	Cascades Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana cascadae	Cascades Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Taricha granulosa	Rough-skinned Newt			
Thamnophis sirtalis sirtalis	Common Gartersnake			
Thamnophis sirtalis sirtalis	Common Gartersnake			
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
INSECTS & OTHER INVERTS				
Agabus lutosus				Not on any status lists
Anax junius	Common Green Darner			
Dytiscus marginicollis				Not on any status lists
Lestes congener	Spotted Spreadwing			
Libellula forensis	Eight-spotted Skimmer			
Libellula nodisticta	Hoary Skimmer			
Libellula pulchella	Twelve-spotted Skimmer			
Libellula saturata	Flame Skimmer			
Plathemis lydia	Common Whitetail			
Sympetrum madidum	Red-veined Meadowhawk			
Sympetrum pallipes	Striped Meadowhawk			
Tanypteryx hageni	Black Petaltail			
MAMMALS				

Castor canadensis	American Beaver			Not on any status lists
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
Sorex palustris	American Water Shrew			Not on any status lists
MOLLUSKS				
Gonidea angulata	Western Ridged Mussel		Special	
Margaritifera falcata	Western Pearlshell		Special	
Gonidea angulata	Western Ridged Mussel		Special	
Margaritifera falcata	Western Pearlshell		Special	
PLANTS				
Bidens cernua	Nodding Beggarticks			
Carex lasiocarpa	Slender Sedge		Special	CRPR - 2B.3
Euthamia occidentalis	Western Fragrant Goldenrod			
Scirpus pendulus	Pendulous Bulrush		Special	CRPR - 2B.2

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

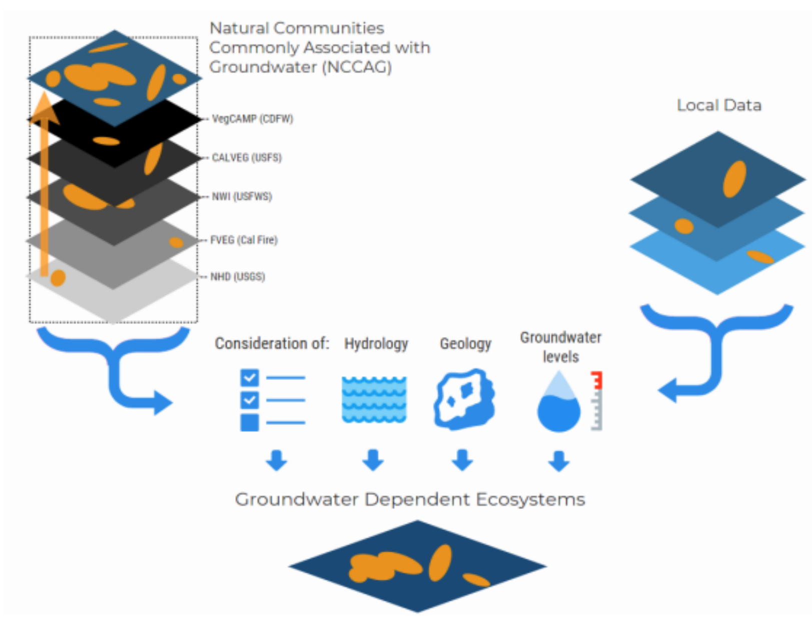


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

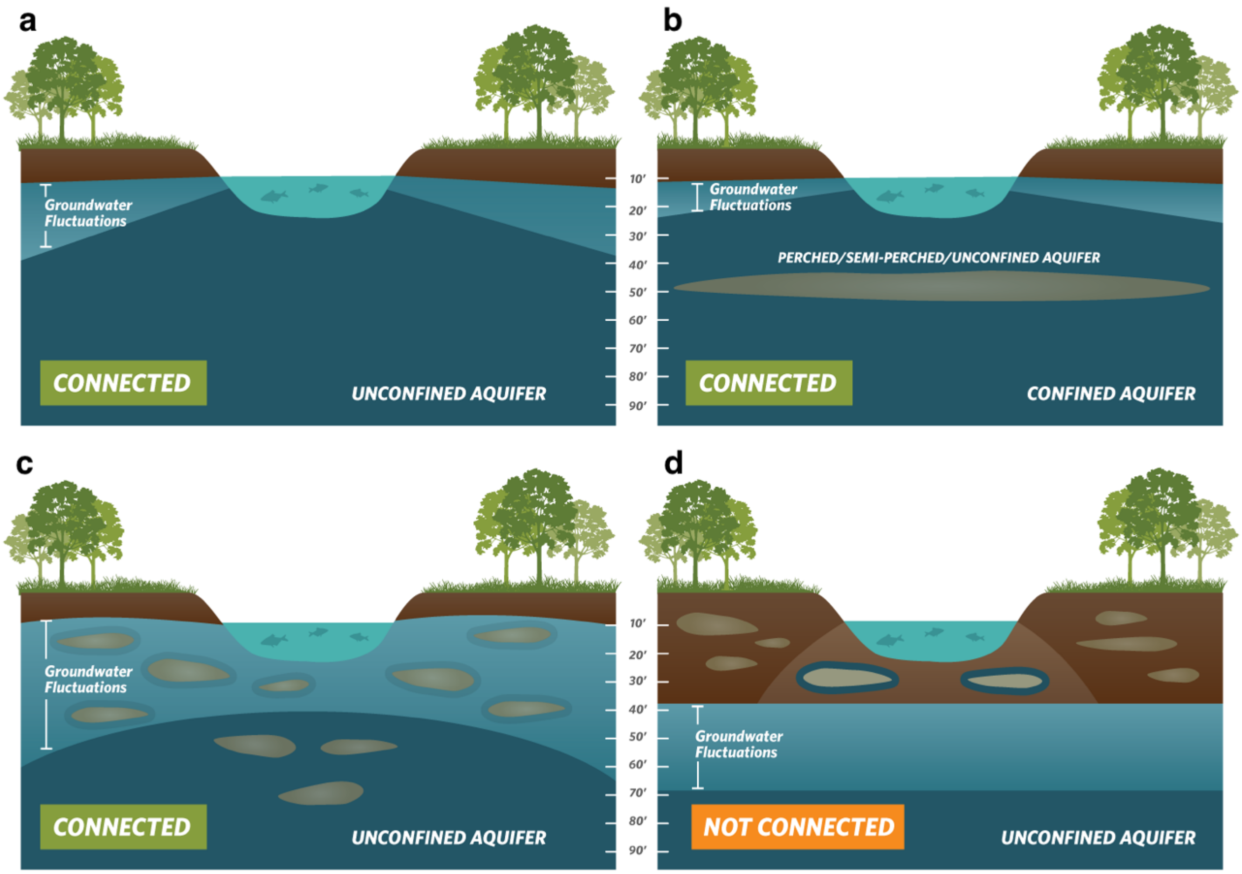

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network (see Best Practice #6).

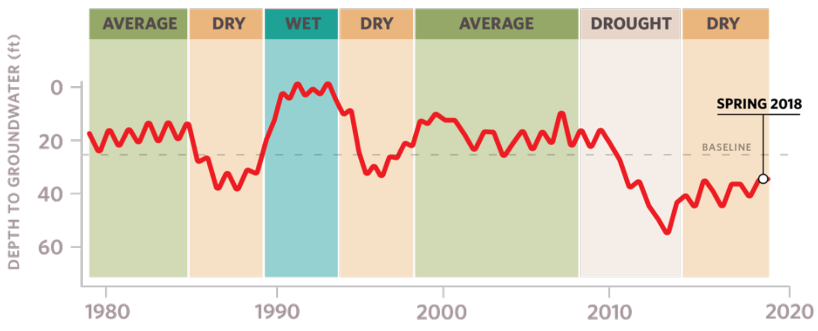

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

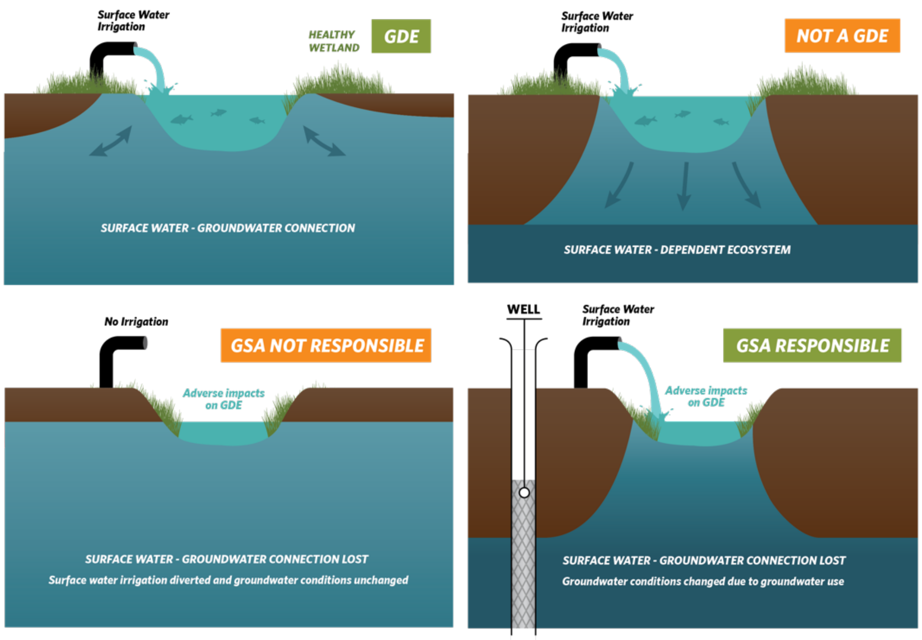

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

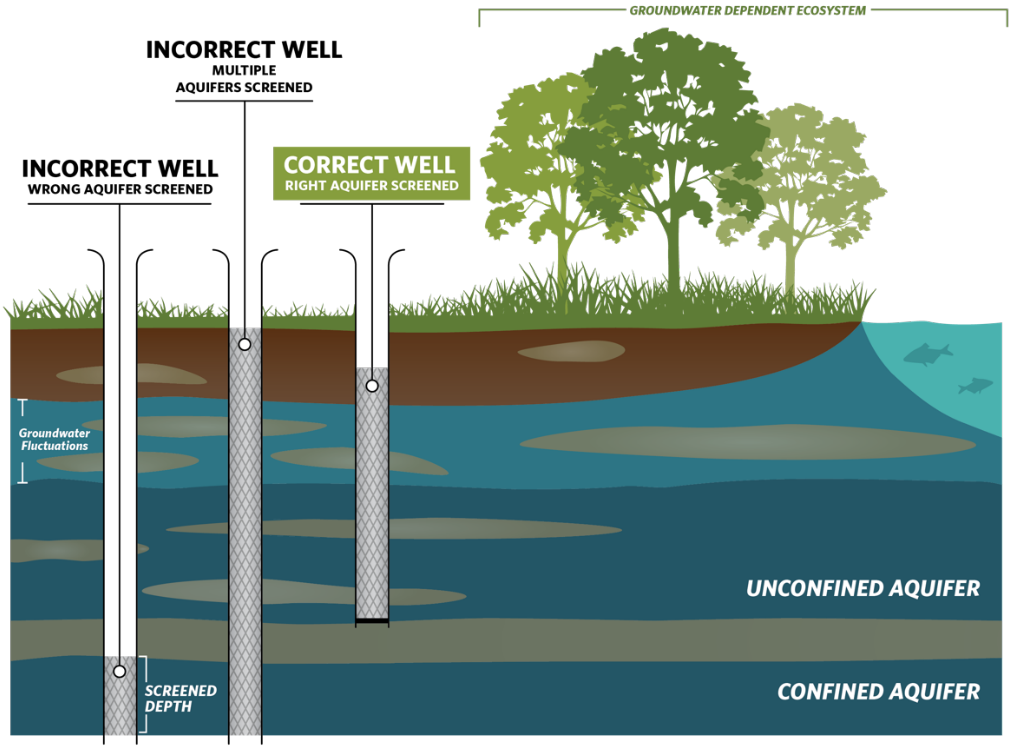

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

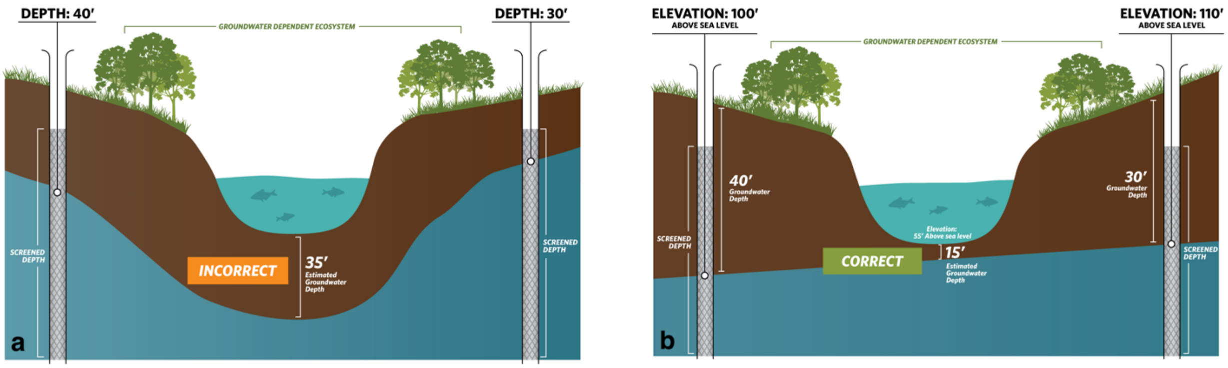

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

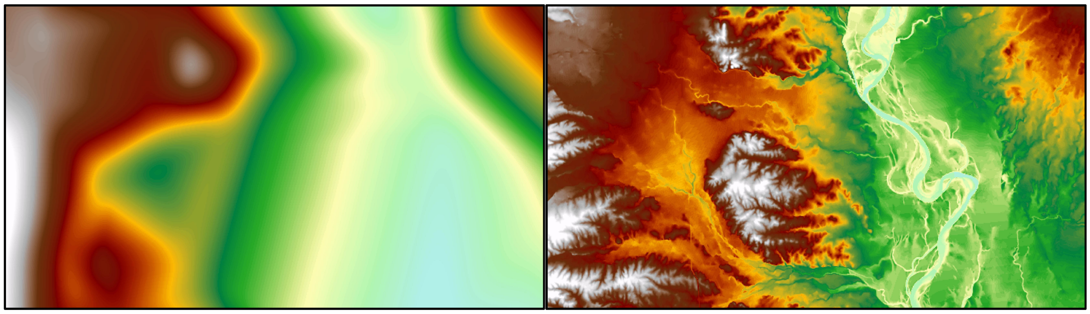

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

November 15, 2021

Sierra Valley Groundwater Management District GSA
PO Box 88
Chilcoot, CA 96105

Submitted via email: lauraf@lwa.com; betsye@lwa.com

Re: Public Comment Letter for Sierra Valley Subbasin Draft GSP

Dear Laura Foglia,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Sierra Valley Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, tribes, drinking water users, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.

2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Sierra Valley Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

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Attachment A

Specific Comments on the Sierra Valley Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes
The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. We note the following deficiencies with the identification of these key beneficial users.

- The GSP states that there are three DACs in the subbasin (Loyalton, Chilcoot-Vinton, and Portola), but these areas are not mapped nor is the population of each provided.
- While the plan describes the historical and cultural affiliations of several tribes in the subbasin, the plan fails to map the locations of tribal lands or tribal interests in the subbasin.
- The GSP provides a map of domestic well density in Figure 2.1.1-7, but fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin. This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the subbasin.
- While the GSP identifies water sources for the subbasin as a whole, it fails to specifically identify the DAC populations dependent on groundwater as their source of drinking water in the subbasin. Specifics are not provided on how much each DAC community relies on a particular water supply (e.g., what percentage is supplied by groundwater).

These missing elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

RECOMMENDATIONS

- Describe and map the locations of DACs and provide the population of each DAC. The DWR DAC mapping tool can be used for this purpose.[2] Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

- Provide a map of tribal lands and describe tribal interests in the subbasin.

- Include a map showing domestic well locations and average well depth across the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **incomplete**. The GSP presents a thorough analysis of stream reaches in the subbasin, but some interconnected reaches may have been disregarded through use of an unusually shallow threshold depth.

The GSP first maps streams in the subbasin with the USGS National Hydrography Dataset Plus High Resolution (NHDPlus HR), which were further verified with field and aerial imagery. The GSP states (p. 2-87): *"For identification of ISW, the average of monitoring well data from the Spring seasons from 2017 to 2020 was used. This period includes an adequate amount of well data and represents a wetter than average period as a conservative approach to identify where groundwater levels may regularly be near the ground surface."* While we recognize that using seasonal high data is a conservative approach, we recommend using groundwater data from multiple seasons and water year types over the pre-SGMA period (i.e., 2005-2015) to determine the range of depth to groundwater. Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs and is necessary to capture the variability in groundwater conditions inherent in California's Mediterranean climate.

The depth-to-groundwater map was prepared by subtracting the groundwater elevation map described above from a 1-meter digital elevation model (DEM). Stream reaches were classified as ISWs where groundwater was within 5 feet of the land surface. It is common practice to utilize deeper thresholds, such as 50 feet below groundwater surface to indicate a disconnected stream reach[3,4]. The GSP confirms the results of the ISW mapping by analyzing vertical gradients from seven sets of nested monitoring wells located throughout the subbasin, most of which have data starting in the early 2000s.

Figure 2.2.2-12 presents the map of interconnected surface water in the subbasin. The map labels areas with groundwater elevation data gaps, but it is unclear whether these reaches in these areas are retained as potential ISWs in the GSP.

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[2] The DWR DAC mapping tool is available online at: https://gis.water.ca.gov/app/dacs/.

[3] Jasechko, S. et al. 2021. Widespread potential loss of streamflow into underlying aquifers across the USA. Nature, 591: 391-395. doi: https://doi.org/10.1038/s41586-021-03311-x

[4] The Nature Conservancy. 2021. ICONS Tool. Available at: https://icons.codefornature.org/

RECOMMENDATIONS
- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.   - Overlay the subbasin's stream reaches on depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis.   - Consider any stream segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **incomplete**. The GSP mapped GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources, including CalVeg mapping, National Wetlands Inventory (NWI) data, and the DWR statewide cropping map. The GSP could be improved by further description of the groundwater data used in the analysis, including the location of monitoring wells, screening depth, and whether they are monitoring the shallow principal aquifer.

The GSP states (2-94): *"The potential GDE map was then overlain with a depth to groundwater raster derived from average groundwater elevation contours from 2017–2020 were subtracted from a 2018 1-m USGS DEM (USGS 2021). Potential GDEs that occur where depth to groundwater exceeds 30 ft were removed from the potential GDE map. Average spring depth to water from 2017 to 2020 was used for this assessment. The average value from 2017 to 2020 was used instead of an individual year because using multiple years allowed for a much more robust estimate of groundwater depth than using a single year alone."* As stated above under the ISW section of the letter, we recommend using groundwater data from multiple seasons and water year types over the pre-SGMA period (i.e., 2005-2015) to determine the range of depth to groundwater. Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying GDEs.

The final GDE map is presented in 2.2.2-13, presenting the 17,581 acres of GDEs in the subbasin. In describing this map, the GSP states (p. 2-96): *"Due to the semi-confined nature of the aquifer system and the spatial and temporal sparseness of measurements, uncertainty in groundwater elevation is quite high. The standard deviation of 2017-2020 average groundwater elevation within a half-mile buffer of the GDEs ranges from 42 to 80 ft Up to 9,500 acres of potential GDEs that were removed because the depth to groundwater exceeded 30 ft could be reclassified as likely GDEs if groundwater elevations increased by one standard deviation. Additional shallow groundwater monitoring well data are needed to reduce uncertainty in depth to water assessments."* Legend labels on this map are the following: Likely, Likely (USFS meadow), Unlikely, Unlikely (agriculture), Unlikely (disconnected surface water), Unlikely (not within 30 feet of groundwater), and Unknown depth to water. We recommend that if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, those polygons are included as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

RECOMMENDATIONS

- Clarify the legend labels used on the GDE map (Figure 2.2.2-13). Clarify the data source for GDE polygons. For example, label polygons retained, removed, or added to/from the NC dataset (include the removal reason if polygons are not considered potential GDEs, or include the data source if polygons are added).

- Provide further description of the groundwater data used in the GDE analysis, including the location of monitoring wells and their screening depth. Ensure the wells are monitoring the shallow principal aquifer.

- If insufficient data are available to describe groundwater conditions within or near GDE polygons, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network. Label the potential GDEs on the GDE map.

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around GDE polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types.

- Provide the depth-to-groundwater contour maps discussed in the GSP text. Show the location of groundwater wells used to create the map, and further discuss the screening depths of the groundwater wells to ensure they are monitoring the shallow principal aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether GDE polygons are supported by groundwater in an aquifer.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[5,6] The integration of native vegetation and managed wetlands into the water budget is **insufficient**.

The water budget section of the GSP and accompanying appendix (Appendix 2-8, Model/Water Budget) were still under preparation at the time of our review. Without these sections of the GSP, we could not evaluate whether the water budget includes the current, historical, and projected demands of these sectors. Inclusion of the explicit demands for native vegetation and managed wetlands is essential so that key environmental uses of groundwater are being accounted for as water supply decisions are made using this budget and considered in project and management actions.

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[5] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[6] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.
- State whether or not there are managed wetlands in the subbasin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Stakeholder Communications & Engagement Plan (Appendix 2).[7]

The GSP identified and engaged with environmental stakeholders during the GSP development process. However, we note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement through public workshops, presentations at Board meetings, print and online media announcements, updates to the GSA website, interested parties email lists, posting flyers at local establishments, distributing surveys in multiple formats, and convening a Technical Advisory Committee consisting of stakeholder interests that meets monthly. While DACs and tribal interests are identified in Chapter 2 of the GSP, there are no specific details of outreach and engagement activities targeted to DACs, tribes, and drinking water users that took place during the GSP development process.
- The Stakeholder Communications & Engagement Plan documents plans to inform the public about the GSP implementation phase through public workshops, posting to the website, and updates at Board meetings, and continuation of the Technical Advisory Committee. Plans to distribute notices in the event of undesirable results are also described. However, the GSP does not include a detailed plan for continual opportunities for engagement through the implementation phase of the GSP that is specifically directed to DACs, drinking water users, tribes, and environmental stakeholders.

RECOMMENDATIONS

- In the Stakeholder Communications & Engagement Plan, describe active and targeted outreach to engage DACs, drinking water users, tribes, and environmental stakeholders throughout the GSP development and implementation phases. Refer to

[7] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the subbasin within the GSP.[8]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[9,10,11]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater level, the GSP uses the following procedure to establish minimum thresholds (p. 3-9): *"To establish SMC a three-step process was followed at each representative monitoring point (RMP). First, the January 2020 to current trend of groundwater levels were linearly projected to January 2032, corresponding to 10 years after GSP submission. Second, the projected groundwater level was compared to the lowest groundwater elevation observed after January 2015. Third, the minimum of the values compared in step two were then reduced by a buffer equal to 10% of the January 2000 to current range of groundwater levels observed at each monitoring point to arrive at the MT. MTs were then rounded down to the nearest integer to ease interpretability. RMPs that show an increase in groundwater level use the observed minimum level as the MT. These SMC effectively give the Subbasin time to respond to corrective action. The 10% buffer allows for operational flexibility to account for potential extreme climate conditions and to accommodate practicable triggers."*

Following the above process, the GSP analyzed the impact to shallow wells through a well impact analysis (Appendix 3-1). The analysis determined that when representative monitoring points (RMPs) reach minimum thresholds, 6-10 domestic wells (or approximately 2% of domestic wells in the subbasin) are impacted. The analysis used a well retirement age of 31-40 years, however, which disqualified about 25% of domestic wells in the subbasin. Furthermore, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold (including those with wells older than 31-40 years old) particularly in light of the lack of a domestic well impact mitigation program in the subbasin. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs, drinking water users or tribes when defining

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[8] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[9] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[10] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[11] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

undesirable results, nor does it describe how the groundwater level minimum thresholds will align and uphold the Human Right to Water policy.[12]

For degraded water quality, constituents of concern (COCs) in the subbasin are nitrate, total dissolved solids (TDS), arsenic, boron, pH, iron, manganese, and MTBE. SMCs are defined for two constituents, nitrate and TDS, as the primary MCL for nitrate and the secondary MCL for TDS. The GSP states (p. 2-27): "*Based on a review of these data, applicable water quality regulations, Subbasin water quality needs, and information from stakeholders, the GSAs determined that state drinking water standards (MCLs and Water Quality Objectives) are appropriate to define MTs for groundwater quality (Table 3.3.4-1). Hence, MTs for groundwater quality are set to the Title 22 primary MCL for nitrate (10 mg/L), and the Title 22 secondary MCL for TDS (500 mg/L).*" However, according to the state's anti-degradation policy,[13] water quality should be protected and is only allowed to degrade if a finding is made that it is in the best interest of the people of the State of California. No analysis has been done and no such finding has been made.

Additionally, the GSP states (p. 3-23): *"Arsenic, boron, pH, iron, and manganese are impacted significantly by natural processes and local geological conditions that are not controllable by the GSAs through groundwater management processes. Therefore, SMCs are not defined for these constituents. Additionally, as detailed in Section 2.2.2.4, MTBE have diminished substantially over the last 10 years: from 2016 to 2020 no exceedances of the 5 µg/L SMCL occurred and the highest concentration measured during this period was 0.7 µg/L, and therefore no SMC is defined for this constituent, and moreover it is associated with contaminated sites that have dedicated monitoring and cleanup and is not likely a risk for future contamination."* However, all COCs in the subbasin that may be impacted or exacerbated by groundwater use and/or management should be included in the SMC, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- In the well impact assessment, include well data from older wells (>31 years old) to better represent minimum threshold impacts to wells across the subbasin.

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

Degraded Water Quality

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when defining undesirable results for degraded water quality.[14] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[15]

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[12] California Water Code §106.3. Available at:
https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3
[13] Anti-degradation Policy
https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf
[14] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]
[15] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act
https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds (expressed in the GSP as maximum thresholds) for degraded water quality on DACs, drinking water users, and tribes.

- Set maximum thresholds and measurable objectives for all water quality constituents within the subbasin that are impacted or exacerbated by groundwater use and/or management.

- Set maximum thresholds that do not allow water quality to degrade to levels at or above the MCL trigger level.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

For chronic lowering of groundwater levels, the GSP analyzes impacts to GDEs as follows. After setting initial minimum thresholds as specified above under Disadvantaged Communities and Drinking Water Users, the SMC at each well were evaluated in terms of their impact on GDEs. Where GDEs were located within a 1-mile radius of the monitoring point, the Normalized Difference Vegetative Index (NDVI) of mapped GDE polygons was used to assess the linkage between groundwater elevation and GDE health. The GSP continues (p. 3-9): *"If a statistically significant relationship exists between depth to groundwater and NDVI the potential impact of MO and MT values was assessed for the monitoring well. For wells screened at more than one depth, only the shallowest screening interval was used. The degree to which NDVI recovered following water elevations close to the MT was investigated to ensure that historical water elevations near the MT did not negatively impact the GDEs (see Chapter 2 for details on GDE NDVI). Where possible, MTs were adjusted to be within the historical range of groundwater elevations so that the impact on GDEs was known. For riverine GDEs, the MT was adjusted to within 10 ft of the ground to promote ISW where reasonable."* The GSP text describes further upward adjustment of the minimum threshold at individual wells to limit impacts to GDEs. We recommend that the GSP provide discussion that adaptive changes in SMC for GDEs will be made, if GDE groundwater or biological monitoring reveals that existing SMC are not protective of these ecosystems.

For depletion of interconnected surface waters, the GSP states that estimation of ISW depletion will be developed through the use of the Sierra Valley integrated surface water-groundwater model, which is in development. In the interim, the GSP states (p. 3-19): *"We set conservative MTs near ISW and GDEs that would maintain groundwater elevations above historically observed lows and thus reduce the risk that hydraulic gradients between surface and groundwater do not reverse or steepen."* The GSP continues: *"To protect priority species that rely on ISW, MTs are set for existing monitoring wells that are located nearest to GDEs and ISW. RMPs associated with ISW or GDEs that support priority species are assigned a groundwater level MT equal to the lowest reading since January 2000 (Figure 3.3.3-1, Figure 3.3.3-2, and Table 3.3.3-1)."* The GSP does not provide further details on how the SMC under development (based on the model) will be evaluated to determine their impacts on GDEs. Furthermore, no analysis or discussion is presented to describe how the current elevation-based SMC will affect beneficial users, and more specifically GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. We recommend that the GSP evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- Provide discussion that adaptive changes in SMC for GDEs will be made, if GDE groundwater or biological monitoring reveals that existing SMC are not protective of these ecosystems.

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[16] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,17]

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[18] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[19] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The water budget section of the GSP and accompanying appendix (Appendix 2-8, Model/Water Budget) were still under preparation at the time of our review. Without these sections of the GSP, we could not evaluate whether the GSP sufficiently integrates climate change into key inputs (e.g., changes in precipitation, evapotranspiration, surface water flow, and imported water) of the projected water budget.

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[16] “The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results.” [23 CCR §354.28(c)(6)]

[17] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California’s threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[18] “Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow.” [23 CCR §354.18(e)]

[19] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

Furthermore, the sustainable yield discussion in the GSP was not finalized, so we could not evaluate whether the sustainable yield was based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omissions of extreme climate scenarios and projected climate change effects on key inputs, and a sustainable yield that is not calculated based on the projected water budget with climate change incorporated, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, domestic well owners, and tribes.

RECOMMENDATIONS

- Present calculations and descriptions (i.e., in tables, figures, and text) for the projected water budget. Ensure that the GSP incorporates climate change into all inputs of the projected water budget.
- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions around DACs and domestic wells in the subbasin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[20]

Figure 3.4.1-1 (RMPs for the Groundwater Level Monitoring Network) shows sufficient spatial representation of DACs and drinking water users for groundwater elevation monitoring, however depth representation cannot be determined from the information provided in the GSP. Figure 3.4.1-2 (Potential Wells for Inclusion in the Groundwater Quality Monitoring Network) shows insufficient representation of DACs and drinking water users for water quality monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify monitored areas.
- Increase the number of RMPs in the shallow aquifer across the subbasin as needed to map ISWs and adequately monitor all groundwater condition indicators across the

[20] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMPs.

- Ensure groundwater elevation and water quality RMPs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.

- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as DACs, drinking water users, and tribes. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

While the GSP (Section 4.3.10) describes the environmental benefits of managed aquifer recharge, the GSP fails to describe the project's explicit benefits or impacts to other beneficial users, such as DACs, within the subbasin. The GSP also fails to include a domestic well mitigation program to avoid significant and unreasonable loss of drinking water.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSAs plan to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[21]

- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

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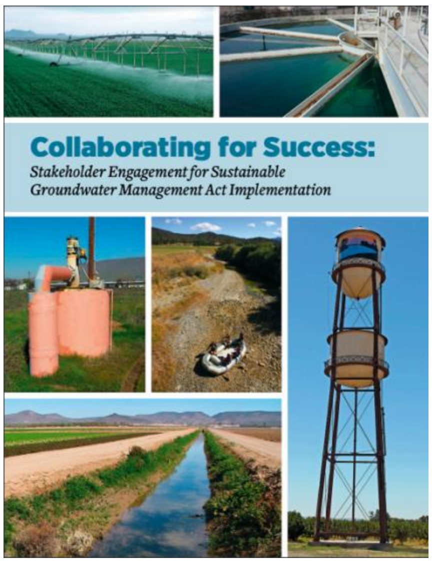
[21] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



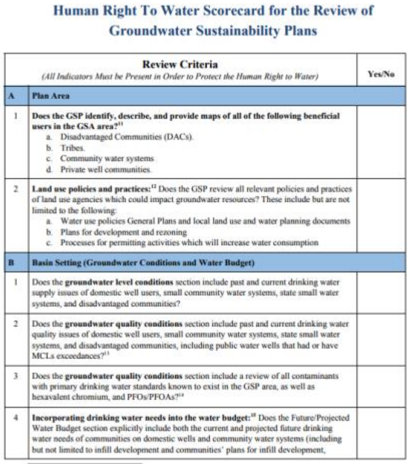
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

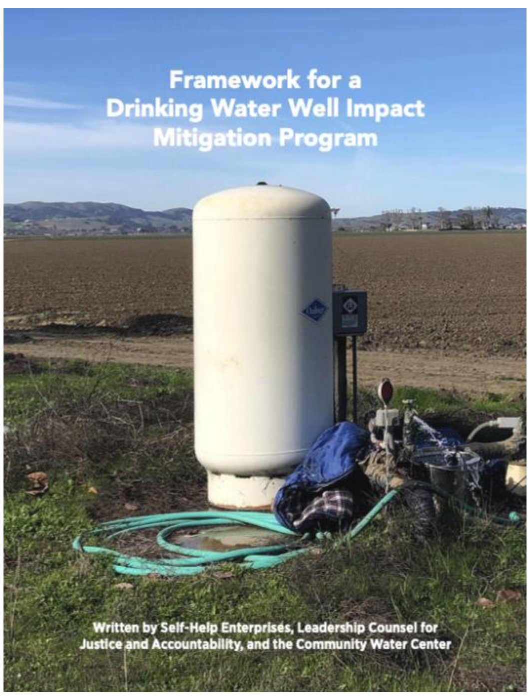
The Human Right to Water


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria (All Indicators Must be Present in Order to Protect the Human Right to Water)	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

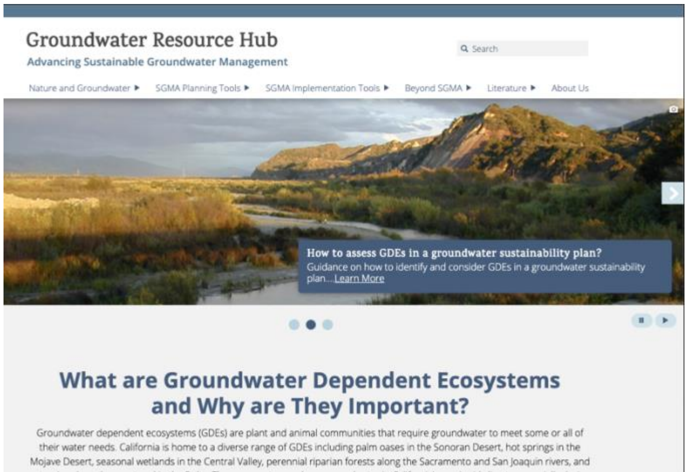
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



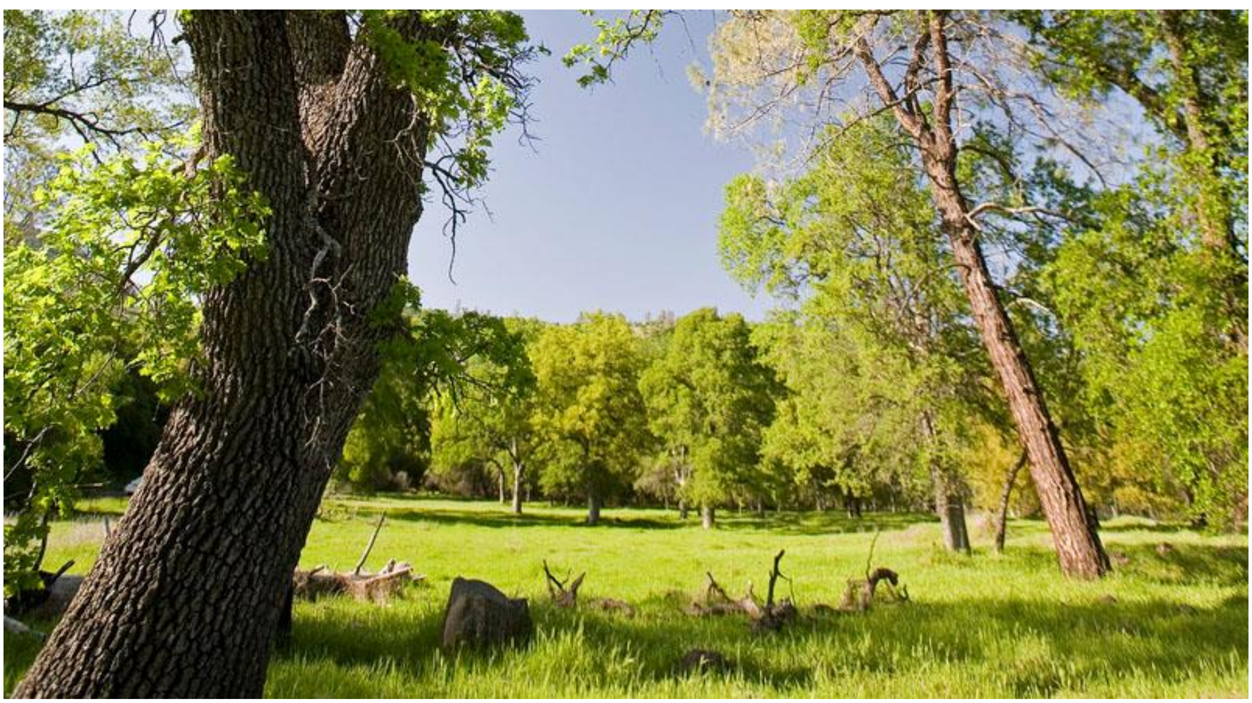
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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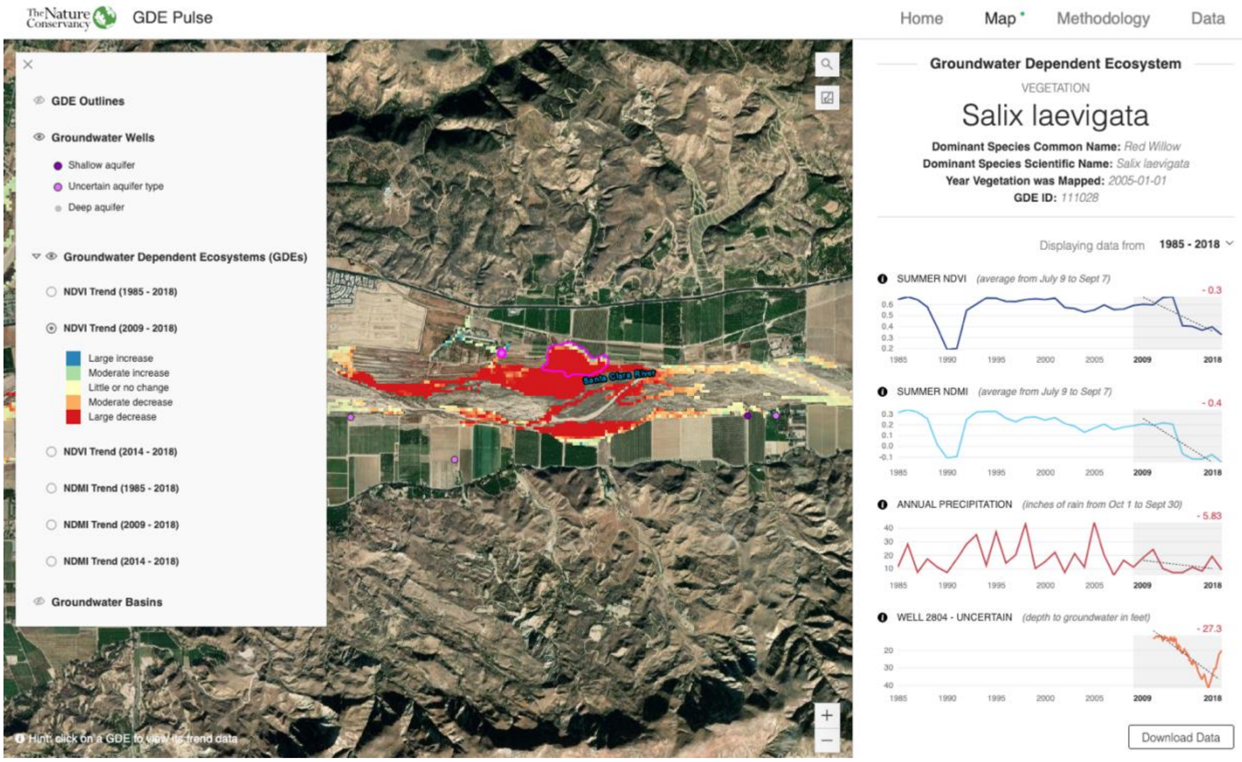
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

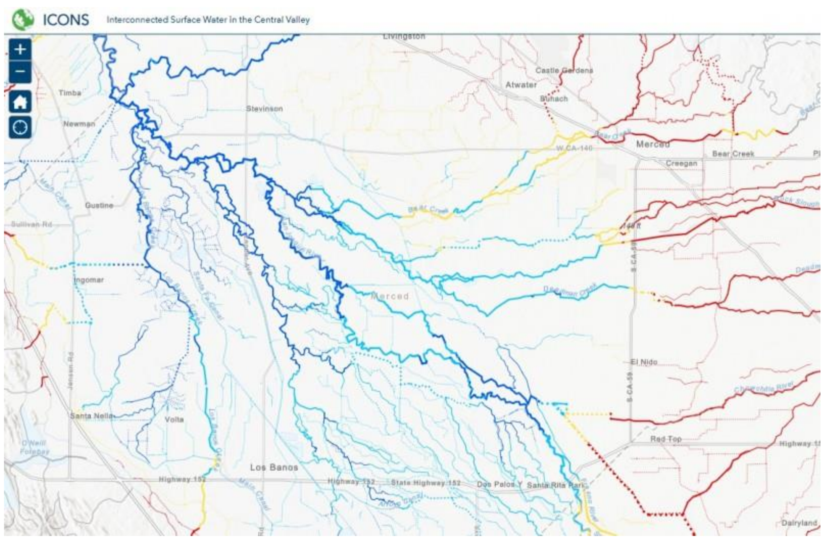
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data [available online](#) from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Sierra Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Sierra Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Grus canadensis tabida	Greater Sandhill Crane		Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Coturnicops noveboracensis	Yellow Rail	Bird of Conservation Concern	Special Concern	BSSC - Second priority
Cygnus buccinator	Trumpeter Swan			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			

Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Cambaridae fam.	Cambaridae fam.			
Hyalella azteca	An Amphipod			
Hyalella spp.	Hyalella spp.			
Pacifastacus spp.	Pacifastacus spp.			
HERPS				
Anaxyrus boreas boreas	Boreal Toad			
Lithobates pipiens	Northern Leopard Frog		Special Concern	ARSSC
Rana sierrae	Sierra Nevada Yellow-legged Frog	Endangered	Candidate Endangered	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis sirtalis sirtalis	Common Gartersnake			

Pseudacris regilla	Northern Pacific Chorus Frog			
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis sirtalis fitchi	Valley Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Acentrella insignificans	A Mayfly			
Acentrella spp.	Acentrella spp.			
Aeshna interrupta interna				
Aeshna palmata	Paddle-tailed Darner			
Agapetus arcita	A Caddisfly			
Agapetus spp.	Agapetus spp.			
Ameletus spp.	Ameletus spp.			
Amiocentrus aspilus	A Caddisfly			
Amphiagrion abbreviatum	Western Red Damsel			
Ampumixis dispar				Not on any status lists
Anax junius	Common Green Darner			
Antocha monticola				Not on any status lists
Antocha spp.	Antocha spp.			
Apatania arizona				Not on any status lists
Apatania spp.	Apatania spp.			
Arctopsyche californica	A Caddisfly			
Arctopsyche grandis	A Caddisfly			
Arctopsyche spp.	Arctopsyche spp.			
Argia agrioides	California Dancer			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Attenella spp.	Attenella spp.			
Baetidae fam.	Baetidae fam.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brachycentrus spp.	Brachycentrus spp.			
Caenis amica	A Mayfly			
Caenis spp.	Caenis spp.			
Calineuria californica	Western Stone			
Callicorixa audeni				Not on any status lists
Callicorixa spp.	Callicorixa spp.			

Camelobaetidius spp.	Camelobaetidius spp.			
Caudatella heterocaudata	A Mayfly			
Caudatella hystrix	A Mayfly			
Caudatella spp.	Caudatella spp.			
Centroptilum spp.	Centroptilum spp.			
Cheumatopsyche analis				Not on any status lists
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chloroperlidae fam.	Chloroperlidae fam.			
Cinygma spp.	Cinygma spp.			
Cinygmula gartrelli	A Mayfly			
Cinygmula spp.	Cinygmula spp.			
Cleptelmis addenda				Not on any status lists
Coenagrionidae fam.	Coenagrionidae fam.			
Coptotomus longulus longulus				Not on any status lists
Corixidae fam.	Corixidae fam.			
Cricotopus nostocicola				Not on any status lists
Cultus spp.	Cultus spp.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Doroneuria baumanni	Cascades Stone			
Doroneuria spp.	Doroneuria spp.			
Drunella coloradensis	A Mayfly			
Drunella doddsii	A Mayfly			
Drunella grandis	A Mayfly			
Drunella spinifera	A Mayfly			
Drunella spp.	Drunella spp.			
Dubiraphia brunnescens	Brownish Dubiraphian Riffle Beetle		Special	
Dubiraphia spp.	Dubiraphia spp.			
Dytiscidae fam.	Dytiscidae fam.			
Elmidae fam.	Elmidae fam.			
Enallagma anna	River Bluet			
Enallagma boreale	Boreal Bluet			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Enallagma cyathigerum				Not on any status lists

Enochrus hamiltoni				Not on any status lists
Epeorus albertae	A Mayfly			
Epeorus spp.	Epeorus spp.			
Ephemerella spp.	Ephemerella spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Ephydridae fam.	Ephydridae fam.			
Erythemis collocata	Western Pondhawk			
Eubrianax edwardsii				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Glossosoma alascense	A Caddisfly			
Glossosoma spp.	Glossosoma spp.			
Graphoderus occidentalis				Not on any status lists
Helodon beardi				Not on any status lists
Helodon spp.	Helodon spp.			
Heptageniidae fam.	Heptageniidae fam.			
Hesperoperla pacifica	Golden Stone			
Heterlimnius corpulentus				Not on any status lists
Heterlimnius spp.	Heterlimnius spp.			
Hydrophilidae fam.	Hydrophilidae fam.			
Hydropsyche alternans				Not on any status lists
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila ajax	A Caddisfly			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ironodes arcticus				Not on any status lists
Ironodes spp.	Ironodes spp.			
Ischnura cervula	Pacific Forktail			
Ischnura perparva	Western Forktail			
Isoperla acula	Fresno Stipetail			
Isoperla spp.	Isoperla spp.			
Kogotus nonus	Smooth Springfly			
Kogotus spp.	Kogotus spp.			
Laccophilus maculosus				Not on any status lists
Lara avara				Not on any status lists
Lara spp.	Lara spp.			

Lepidostoma acarolum				Not on any status lists
Lepidostoma spp.	Lepidostoma spp.			
Leptoceridae fam.	Leptoceridae fam.			
Leptophlebiidae fam.	Leptophlebiidae fam.			
Lestes dryas	Emerald Spreadwing			
Lestes unguiculatus	Lyre-tipped Spreadwing			
Leucorrhinia intacta	Dot-tailed Whiteface			
Leucrocuta jewetti				Not on any status lists
Leucrocuta spp.	Leucrocuta spp.			
Libellula forensis	Eight-spotted Skimmer			
Libellula luctuosa	Widow Skimmer			
Libellula pulchella	Twelve-spotted Skimmer			
Libellula quadrimaculata	Four-spotted Skimmer			
Libellula saturata	Flame Skimmer			
Limnochares spp.	Limnochares spp.			
Malenka bifurcata				Not on any status lists
Malenka spp.	Malenka spp.			
Micrasema arizonica				Not on any status lists
Micrasema spp.	Micrasema spp.			
Micropsectra spp.	Micropsectra spp.			
Mideopsis spp.	Mideopsis spp.			
Mystacides spp.	Mystacides spp.			
Nemouridae fam.	Nemouridae fam.			
Neophylax occidentis	A Caddisfly			
Neophylax spp.	Neophylax spp.			
Neotrichia spp.	Neotrichia spp.			
Nothotrichia shasta				Not on any status lists
Ochthebius spp.	Ochthebius spp.			
Oecetis arizonica				Not on any status lists
Oecetis spp.	Oecetis spp.			
Ophiogomphus arizonicus				Not on any status lists
Ophiogomphus spp.	Ophiogomphus spp.			
Optioservus canus	Pinnacles Optioservus Riffle Beetle		Special	

Optioservus quadrimaculatus				Not on any status lists
Optioservus spp.	Optioservus spp.			
Ordobrevia nubifera				Not on any status lists
Oreodytes spp.	Oreodytes spp.			
Orohermes crepusculus				Not on any status lists
Pachydiplax longipennis	Blue Dasher			
Paracymus communis				Not on any status lists
Paraleptophlebia spp.	Paraleptophlebia spp.			
Paraperla frontalis	Hyporheic Sallfly			
Paraperla spp.	Paraperla spp.			
Parapsyche almota	A Caddisfly			
Parapsyche elsis	A Caddisfly			
Parapsyche spp.	Parapsyche spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Pedomoecus sierra	A Caddisfly			
Peltodytes callosus				Not on any status lists
Peltoperlidae fam.	Peltoperlidae fam.			
Perlidae fam.	Perlidae fam.			
Perlinodes aurea	Longgill Springfly			
Perlodidae fam.	Perlodidae fam.			
Petrophila spp.	Petrophila spp.			
Plathemis lydia	Common Whitetail			
Polypedilum spp.	Polypedilum spp.			
Protoptila spp.	Protoptila spp.			
Psychodidae fam.	Psychodidae fam.			
Psychoglypha alascensis				Not on any status lists
Psychoglypha spp.	Psychoglypha spp.			
Ptychoptera spp.	Ptychoptera spp.			
Ptychopteridae fam.	Ptychopteridae fam.			
Rhionaeschna multicolor	Blue-eyed Darner			
Rhithrogena decora	A Mayfly			
Rhithrogena spp.	Rhithrogena spp.			
Rhizelmis nigra				Not on any status lists
Rhyacophila acuminata	A Caddisfly			Not on any status lists
Rhyacophila spp.	Rhyacophila spp.			
Rickera sorpta	Palestripe Springfly			

Serratella levis	A Mayfly			
Serratella spp.	Serratella spp.			
Sialis spp.	Sialis spp.			
Simulium anduzei				Not on any status lists
Simulium spp.	Simulium spp.			
Skwala americana	American Springfly			
Skwala spp.	Skwala spp.			
Sperchon spp.	Sperchon spp.			
Stictotarsus spp.	Stictotarsus spp.			
Sweltsa adamantea				Not on any status lists
Sweltsa spp.	Sweltsa spp.			
Sympetrum corruptum	Variegated Meadowhawk			
Sympetrum madidum	Red-veined Meadowhawk			
Sympetrum occidentale				Not on any status lists
Sympetrum pallipes	Striped Meadowhawk			
Tanytarsus spp.	Tanytarsus spp.			
Tipulidae fam.	Tipulidae fam.			
Tramea lacerata	Black Saddlebags			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus columbianus				Not on any status lists
Tropisternus lateralis				Not on any status lists
Tvetenia spp.	Tvetenia spp.			
Uenoidae fam.	Uenoidae fam.			
Uvarus amandus				Not on any status lists
Uvarus spp.	Uvarus spp.			
Wormaldia anilla	A Caddisfly			
Wormaldia spp.	Wormaldia spp.			
Yoraperla brevis	Least Roachfly			
Yoraperla spp.	Yoraperla spp.			
Yphria californica	A Caddisfly			
Zaitzevia parvula				Not on any status lists
Zaitzevia spp.	Zaitzevia spp.			
Zapada cinctipes	Common Forestfly			
Zapada spp.	Zapada spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists

Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
Sorex palustris	American Water Shrew			Not on any status lists
MOLLUSKS				
Ferrissia spp.	Ferrissia spp.			
Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus spp.	Gyraulus spp.			
Lymnaea spp.	Lymnaea spp.			
Margaritifera falcata	Western Pearlshell		Special	
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Planorbidae fam.	Planorbidae fam.			
Sphaeriidae fam.	Sphaeriidae fam.			
PLANTS				
Juncus luciensis	Santa Lucia Dwarf Rush		Special	CRPR - 1B.2
Alopecurus aequalis aequalis	Short-awn Foxtail			
Alopecurus geniculatus geniculatus	Meadow Foxtail			
Alopecurus saccatus	Pacific Foxtail			
Beckmannia syzigachne	American Sloughgrass			
Bidens cernua	Nodding Beggarticks			
Bistorta bistortoides				Not on any status lists
Cicuta douglasii	Western Water-hemlock			
Cyperus squarrosus	Awned Cyperus			
Damasonium californicum				Not on any status lists
Downingia bacigalupii	Bacigalup's Downingia			
Downingia bicornuta	NA			
Downingia cuspidata	Toothed Calicoflower			
Elatine brachysperma	Shortseed Waterwort			
Elatine californica	California Waterwort			
Elatine heterandra	Mosquito Waterwort			

Eleocharis bella	Delicate Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Epilobium oreganum	Oregon Willowherb		Special	CRPR - 1B.2
Eryngium alismifolium	Inland Coyote-thistle			
Glyceria borealis	Small Floating Mannagrass			
Gratiola ebracteata	Bractless Hedge-hyssop			
Hippuris vulgaris	Common Mare's-tail			
Hypericum anagalloides	Tinker's-penny			
Isoetes howellii	NA			
Juncus chlorocephalus	Green-head Rush			
Juncus hemiendytus hemiendytus	Dwarf Rush			
Juncus macrandrus	Long-anther Rush			
Kobresia myosuroides	Pacific Kobresia		Special	CRPR - 2B.3
Lemna gibba	Inflated Duckweed			
Lemna minor	Lesser Duckweed			
Lemna turionifera	Turion Duckweed			
Limosella acaulis	Southern Mudwort			
Limosella aquatica	Northern Mudwort			
Limosella australis	NA		Special	CRPR - 2B.1
Lythrum portula	NA			
Marsilea oligospora	NA			
Mimulus guttatus	Common Large Monkeyflower			
Myosurus apetalus	Bristly Mousetail			
Myosurus minimus	NA			
Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Navarretia leucocephala minima	Least Navarretia			
Perideridia bolanderi bolanderi	Bolander's Yampah			
Perideridia lemmonii	Lemmon's Yampah			

Perideridia parishii latifolia	Parish's Yampah			
Persicaria amphibia				Not on any status lists
Pilularia americana	NA			
Plagiobothrys reticulatus reticulatus				Not on any status lists
Porterella carnosula	Western Porterella			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Ranunculus alismifolius alismifolius	Water-plantain Buttercup			
Ranunculus aquatilis aquatilis	White Water Buttercup			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rumex salicifolius salicifolius	Willow Dock			
Salix exigua exigua	Narrowleaf Willow			
Senecio triangularis	Arrow-leaf Groundsel			
Sium suave	Hemlock Water-parsnip			
Veronica peregrina	NA			
Veronica scutellata	Marsh-speedwell			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

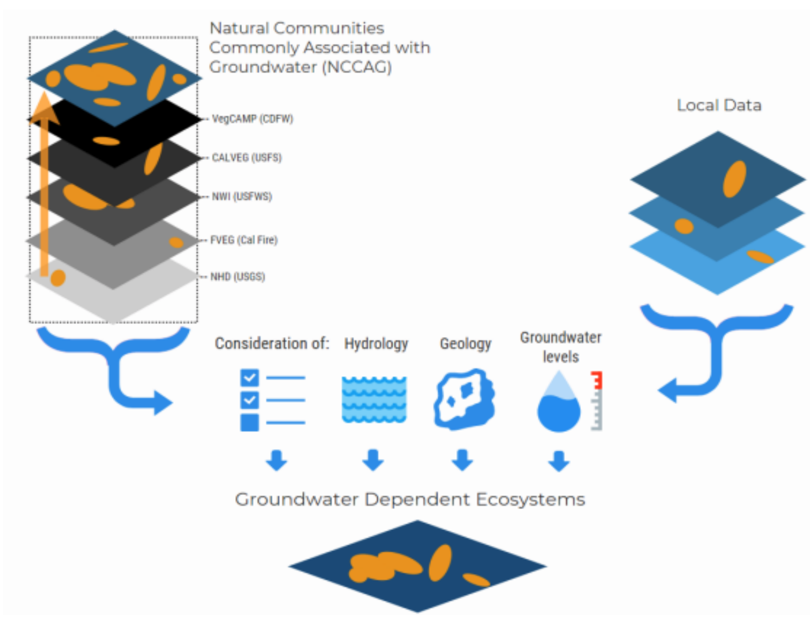


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

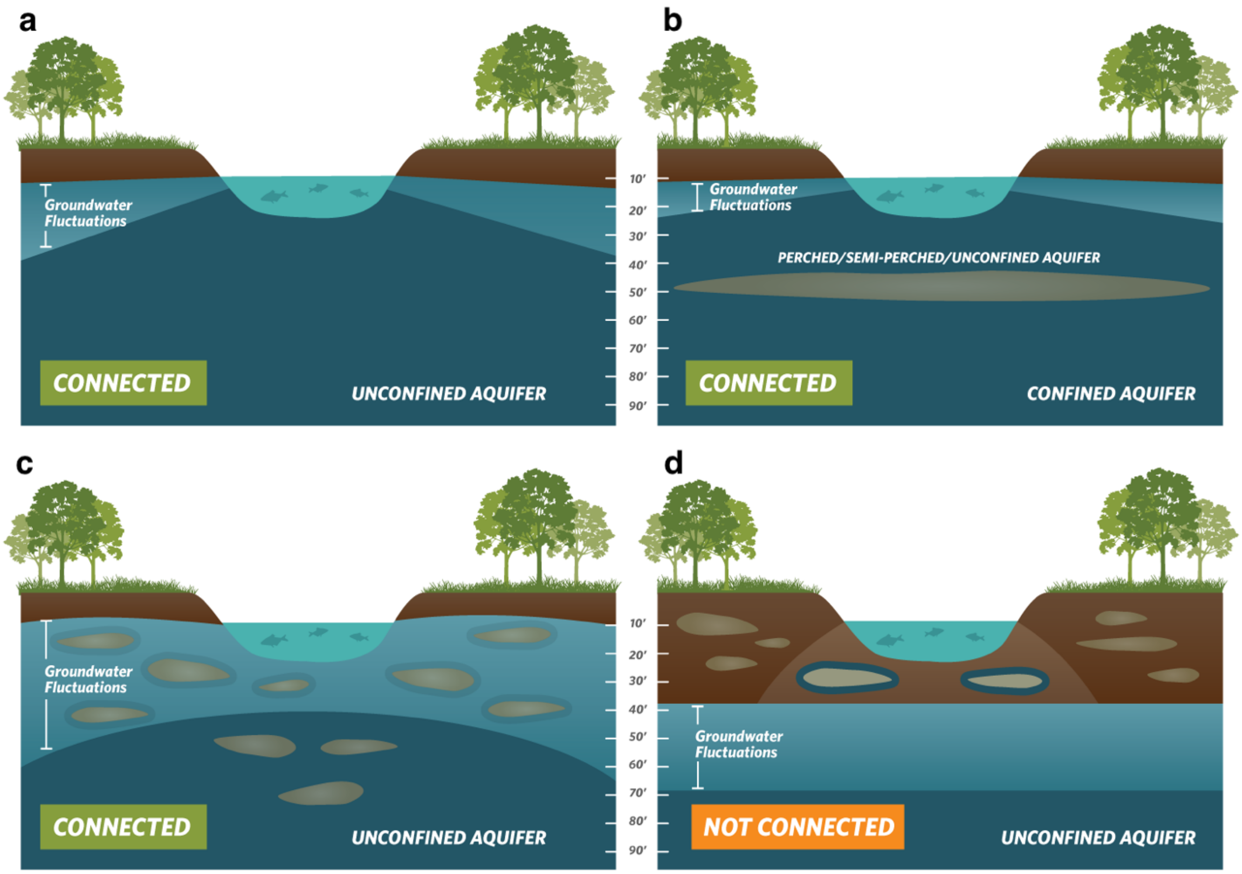

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

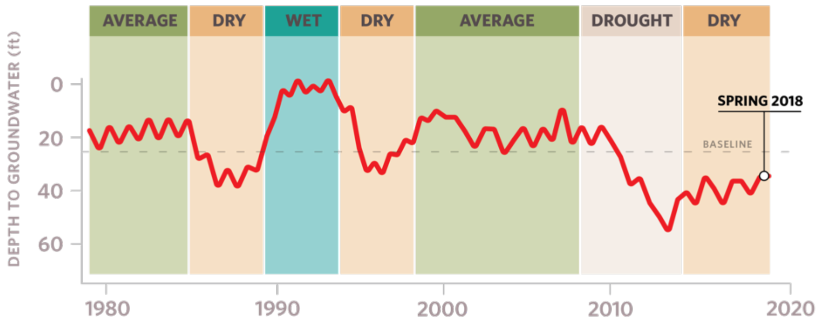

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

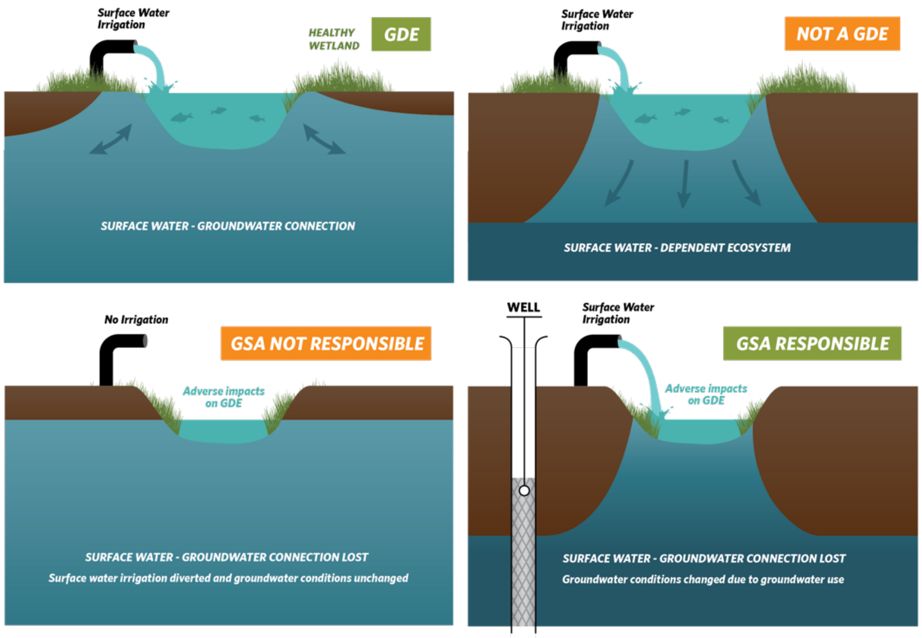

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

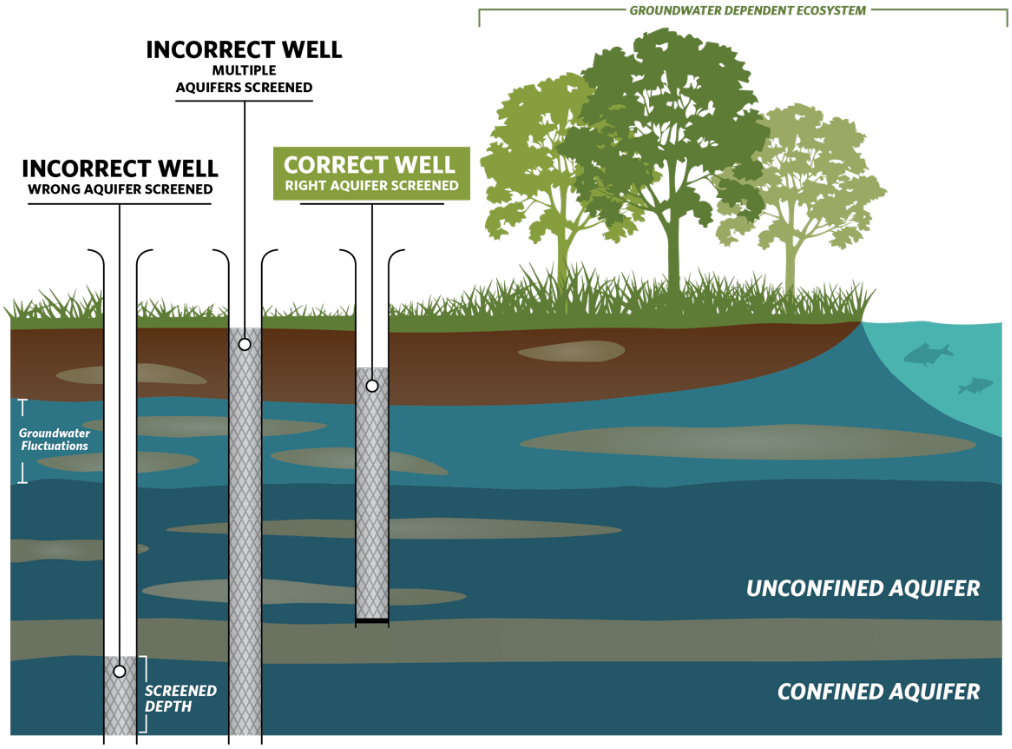

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

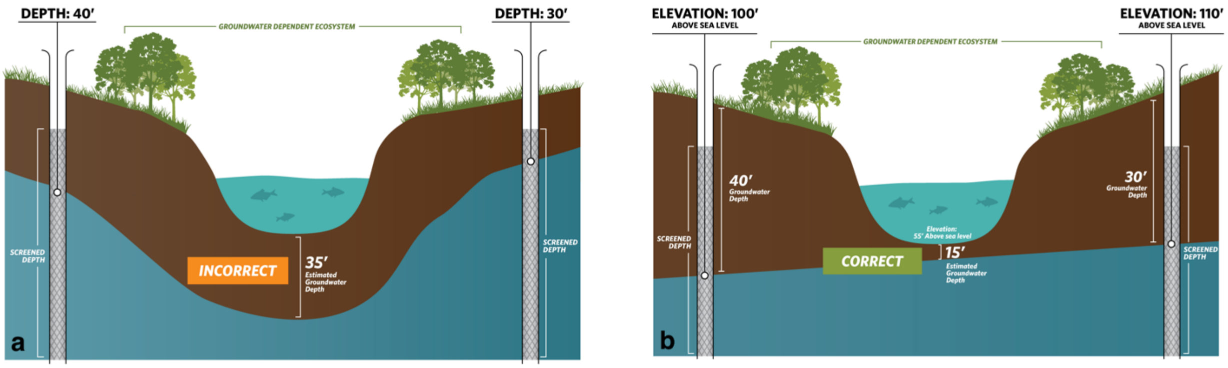

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

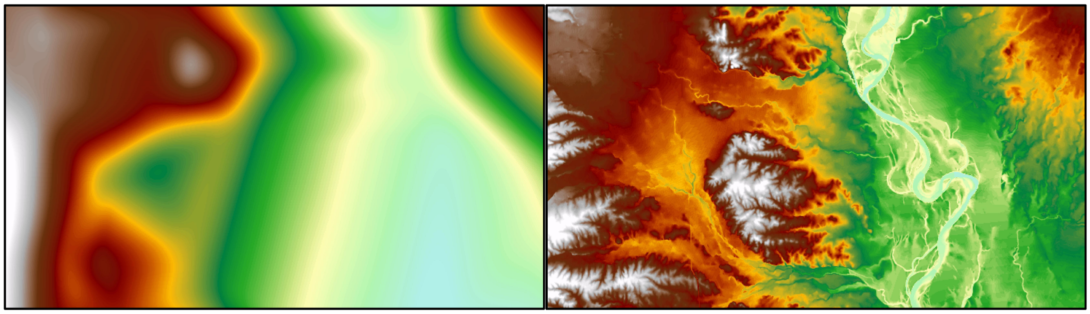

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

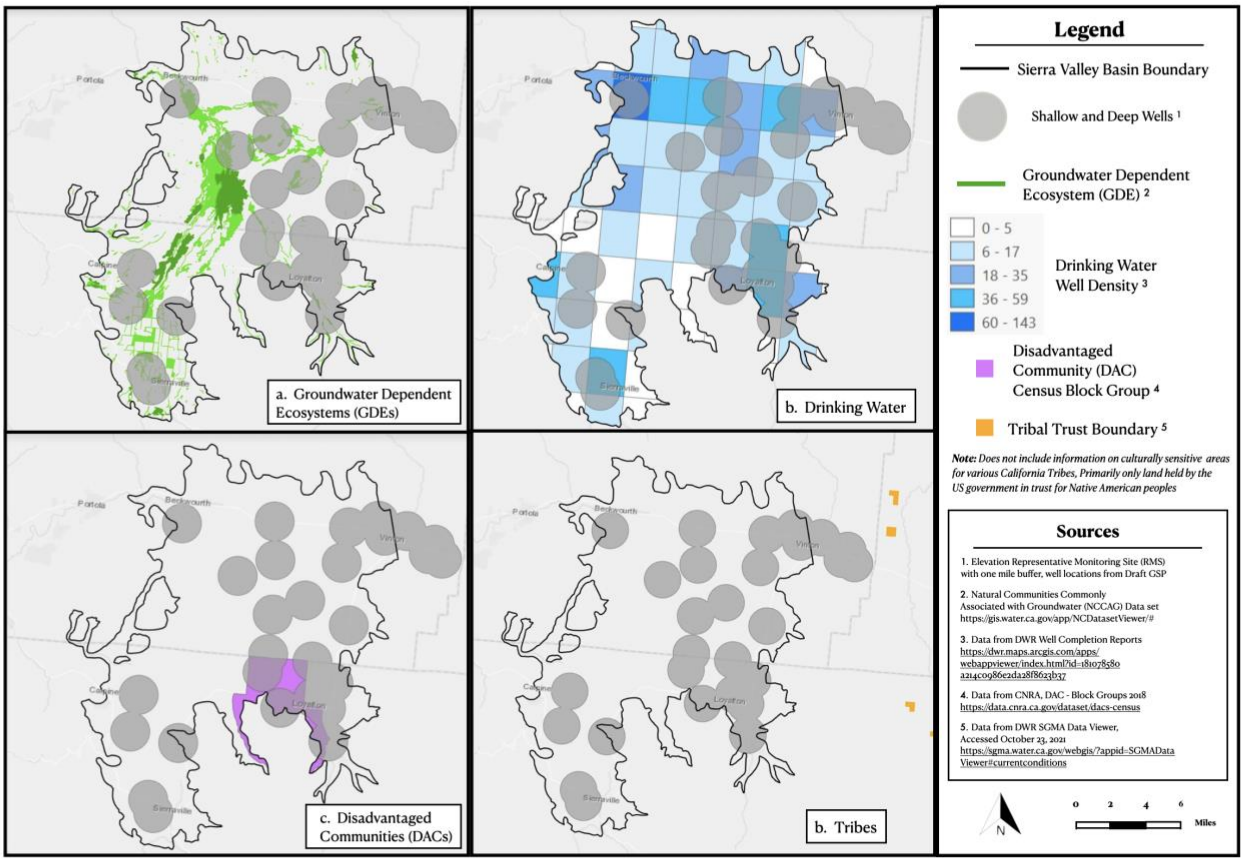

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes. Note: Tribal lands are not present within the subbasin boundaries.

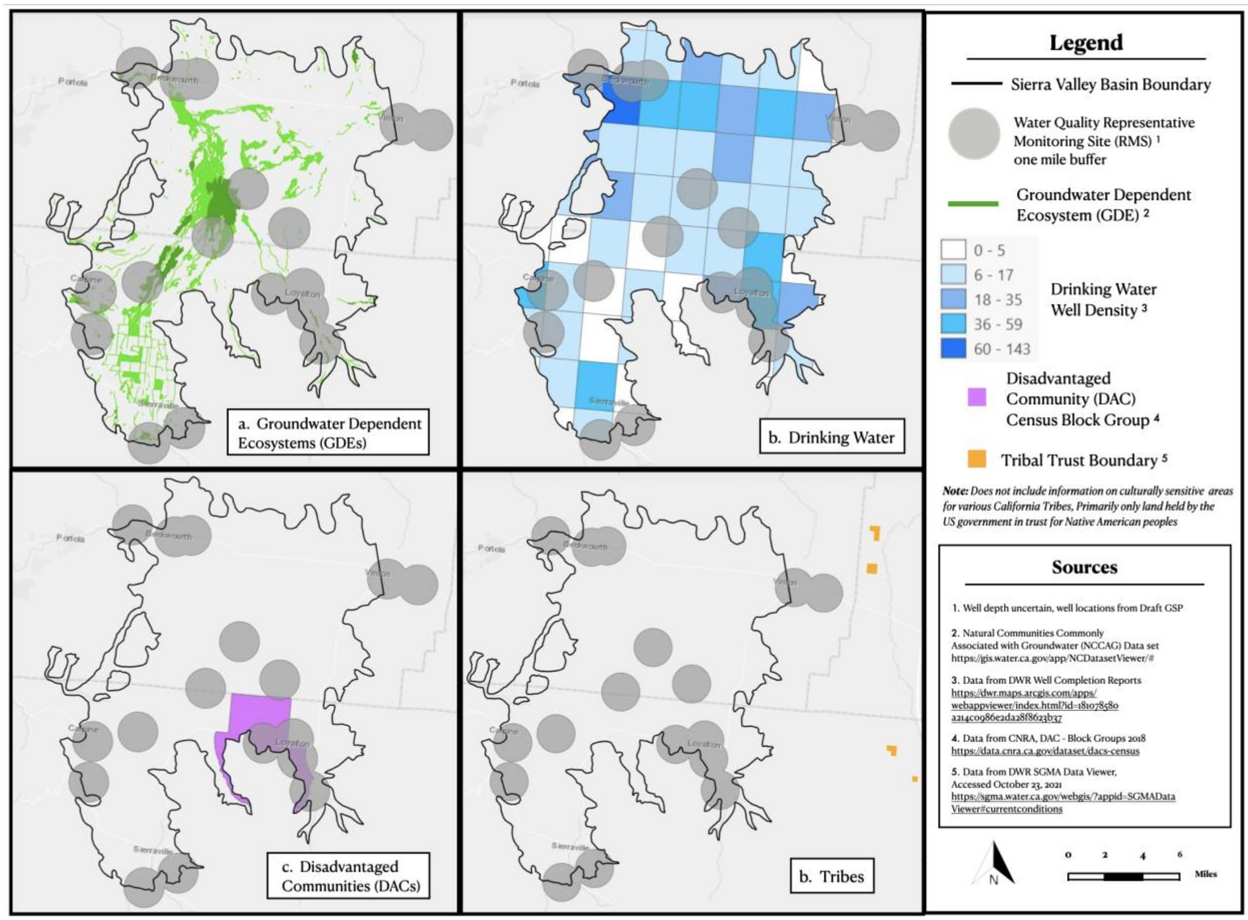

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes. Note: Tribal lands are not present within the subbasin boundaries.

November 15, 2021

Solano Subbasin GSA Collaborative
810 Vaca Valley Parkway
Vacaville, CA 95688

Submitted via email: SolanoGSP-Comments@KennedyJenks.com

Re: Public Comment Letter for Solano Subbasin Draft GSP

Dear Chris Lee,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Solano Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Solano Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Amy Merrill, Ph.D.
Acting Director, California Program
American Rivers

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Solano Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP provides information on DACs and SDACs, including identification by name and location on a map. The GSP also identifies the population of each identified DAC and SDAC and describes the population dependent on groundwater as their source of drinking water in the subbasin.

While the plan provides a density map of domestic wells in the subbasin (Figure 2-13), the GSP fails to provide a map of well depth (such as minimum well depth, average well depth, or depth range) within the subbasin. This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the subbasin.

This missing element is required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATION
• Include a map showing domestic well locations and average well depth across the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **sufficient**. The GSP evaluates the potential for interconnection between groundwater and surface water by comparing the depth to groundwater at multiple years between 2000 and 2018 at locations along mapped surface water reaches in the subbasin. The GSP presents detailed studies of interconnectivity along Putah

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

Creek in Appendix 3B. Data gaps that exist along Putah Creek and in the central portion of the Subbasin near the Delta are discussed in Appendix 3B. Figure 3-17 presents the conclusions of the ISW analysis, showing stream reaches in the subbasin labeled as Likely Connected-Gaining (DTW <0), Likely Connected-Transition (DTW 0-10), Likely Connected-Losing (DTW 10-20), Probably Disconnected (DTW 20-50), and Likely Disconnected (DTW>50).

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **incomplete**. The GSP mapped GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset), with additional data from the Solano Habitat Conservation Plan (HCP) and the San Francisco Estuary Institute (SFEI) California Aquatic Resource Inventory (CARI) dataset. The GSP used depth-to-groundwater maps, developed using ground surface elevation from a digital elevation model (DEM), from multiple years (2000, 2005, 2010, 2015, and 2018) to identify the likely locations of GDE communities. Likely GDEs in the subbasin were identified in areas where depth to groundwater was less than 30 feet. Figure 5-6 (Appendix 3B) presents likely GDEs in the subbasin.

The GSP presents a summary of GDE vegetation and wetland types in Table 5-1, and summarizes and maps critical habitats for threatened and endangered species in Table 5-2 and Figure 5-4. The GSP states (Appendix 3B p. 14): *"The Subbasin has two types of oak trees, the Coast Live Oak and the Valley Oak, which are located primarily on the western edge of the Subbasin to the north of Vacaville. The maximum rooting depth for oak trees ranges from 24 to 35 feet."* We recommend that an 80-foot depth-to-groundwater threshold be used when inferring whether Valley Oak polygons in the NC dataset are likely reliant on groundwater. This recommendation is based on a recent correction in TNC's rooting depth database,[2] after finding a typo in the max rooting depth units for Valley Oak. This resulted in a specific change in the max rooting depth of Valley Oak from 24 feet to 24 meters (80 feet). For all other phreatophytes, we continue to recommend that a 30-foot depth-to-groundwater threshold be used when inferring whether all other NC dataset polygons are likely reliant on groundwater.

The GSP states (Appendix 3B, p. 16): *"The HCP, CARI and SFEI datasets identified additional wetlands that account for 42% of the Subbasin; however, these datasets are older and many of these older mapped wetland areas are located within areas mapped as agricultural in recent land use surveys. The Subbasin GSAs recognize these areas as potential wetlands but are not considering them groundwater dependent at this time."* If these potential wetlands are present in areas with data gaps, we recommend that they be retained as potential GDEs in the GSP until the data gaps are filled.

RECOMMENDATIONS
● Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as Valley Oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether Valley Oak polygons from the NC Dataset are connected to groundwater. It is important to emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

[2] TNC. 2021. Plant Rooting Depth Database. Available at: https://groundwaterresourcehub.org/sgma-tools/gde-rooting-depths-database-for-gdes/

- If insufficient data are available to describe groundwater conditions within or near mapped wetlands and riparian communities, include those areas as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[3,4] The integration of these ecosystems into the water budget is **sufficient**.

The water budget explicitly includes the current, historical, and projected demands of native vegetation. The main GSP text (Table 5-15) does not separate out native vegetation, but Table 4-9 in Appendix 5C (historic, current) and Table 5A-25 in Appendix 5A (projected) do separate evapotranspiration by sector, including native vegetation. For clarity, we would like to see this separation by water use sector in the main GSP text in addition to the appendices.

The GSP did not include the current, historical, and projected demands of managed wetlands. The GSP states (Appendix 3B, p. 16): *"The HCP, CARI and SFEI datasets identified additional wetlands that account for 42% of the Subbasin; however, these datasets are older and many of these older mapped wetland areas are located within areas mapped as agricultural in recent land use surveys. The Subbasin GSAs recognize these areas as potential wetlands but are not considering them groundwater dependent at this time."* The GSP does not state if these areas include any *managed* wetlands. Managed wetlands are present in DWR's 2016 statewide cropping dataset. If there are wetlands present in the basin that are not groundwater dependent, then they should be identified as managed wetlands and included in the water budget as a specific water use sector. If managed wetlands are present, the omission of explicit water demands for this water use sector is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

RECOMMENDATIONS

- Include evapotranspiration separately for each sector (including native vegetation) in the main GSP text, in addition to the appendices.

- Discuss and map the presence of managed wetlands in the subbasin, if present. Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including managed wetlands.

[3] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[4] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**, due to inadequate inclusion of DACs into the decision-making structure of the GSP development process. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Public Outreach and Communications and Engagement Activities Appendix (Appendix 2A).[5]

The GSP documents a wide range of opportunities for public involvement and engagement broadly provided to all listed stakeholders. These activities included public engagement meetings via Zoom with Spanish language translation; in-person open house meetings with Spanish language translation and childcare provisions; notices via email, postcards, and newsletters to an interested parties list; notices via local newspapers, radio announcements, and community partners; a Community Advisory Committee (CAC) with representatives from beneficial users across the subbasin to provide input; focus groups; public forums; Solano Subbasin Surveys; and updates to the GSP website. To conduct outreach to DACs, the GSA Collaborative interviewed community members (including groups working directly with family and children such as Solano Family and Children Services, Child Development Centers, Continuing Development Incorporated, and Rio Vista CARE) for recommendations on effective outreach strategies with vulnerable communities during the GSP process. The plan also includes a session on how stakeholder input was incorporated into GSP development.

The GSA Collaborative engaged with environmental stakeholders through inclusion of environmental interests on the CAC. Appendix 2A describes and summarizes meetings and interviews with members of the CAC and other environmental stakeholders. The GSP describes continued stakeholder engagement through GSP implementation in the Implementation Community Engagement Plan included in Appendix 2A.

However, we note the following deficiencies with the stakeholder engagement process:

- The GSP does not make clear whether DACs are represented on the Community Advisory Committee.
- While the plan includes details on how input was solicited and feedback received from stakeholders, it fails to comprehensively document how this feedback from stakeholders resulted in direct improvement or changes to the GSP development process.

RECOMMENDATIONS
• Include DAC representatives on the Community Advisory Committee. Additionally, provide further documentation of each stakeholder represented on the committee to clarify the representation of stakeholder groups. • In the Public Outreach and Communications and Engagement Activities Appendix, comprehensively describe how outreach to stakeholders resulted in changes to the

[5] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

GSP development process. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Include a summary of the key stakeholder engagement activities in the main GSP text, due to the length and detail provided in Appendix 2A.

- Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the subbasin.[6]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[7,8,9]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, minimum thresholds are established at the minimum groundwater elevation of the historical base period (1991 to 2015) where this was determined to provide sufficient operational flexibility in the subbasin. At some representative monitoring sites (RMSs), the minimum threshold is set five feet below the deepest depth to water over the base period to allow for operational flexibility. The GSP analyzed the impact of minimum thresholds on domestic wells, and concluded that if groundwater levels were to reach minimum threshold elevations across the subbasin, two wells constructed since 1970 have the potential to go dry (defined as the well having less than 10 feet of saturated screen). However, the GSP does not state whether the number or percentage of domestic wells that fit this criteria (i.e., constructed since 1970) represent a significant portion of domestic wells in the basin. Furthermore, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold (including those with wells older than 50 years old). In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs when defining undesirable results, nor does it describe how the groundwater level minimum thresholds are consistent with Human Right to Water policy and will avoid significant and unreasonable impacts on DACs.[10]

For degraded water quality, the minimum threshold for each of the constituents of concern (nitrate, arsenic, TDS, chloride, and hexavalent chromium) are established as the drinking water

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[6] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[7] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[8] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[9] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[10] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

maximum contaminant level (MCL) or the existing constituent concentration plus 20 percent, whichever is greater. Additionally, for measurable objectives, the plan sets trigger levels for constituents with primary MCL minimum threshold at 75% of the MCL and adds that the trigger initiates evaluation of factors related to increasing constituent concentrations. However, according to the state's anti-degradation policy,[11] high water quality should be protected and is only allowed to worsen if a finding is made that it is in the best interest of the people of the State of California.

The GSP states (p. 6-35): *"Monitoring and remediation of groundwater quality is regulated under various programs including both non point-source and point-source waste discharges and contamination sites. The GSAs plan to coordinate with and work cooperatively with agencies and programs that have jurisdiction over groundwater quality issues in the Solano Subbasin to avoid adverse impacts to groundwater quality conditions in the Subbasin from groundwater management activities related to the GSP."* However, SMC should be established for all COCs in the subbasin impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- In the well impact assessment, include well data from older wells (>50 years old) to better represent minimum threshold impacts to wells across the subbasin.

- Describe direct and indirect impacts on DACs and drinking water users when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

Degraded Water Quality

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality.[12] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[13]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that may be impacted by groundwater use and/or management.

- Similar to the trigger levels for measurable objectives, set minimum thresholds that do not allow water quality to degrade to the MCL level.

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[11] Anti-degradation Policy https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf

[12] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[13] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

For chronic lowering of groundwater levels, sustainable management criteria do not consider impacts to GDEs. The GSP states (p. 6-32): "*Environmental uses include GDEs for which data gaps have been identified and new monitoring installations are planned. Initially, a baseline shall be established to provide a basis for identifying effects of chronic lowering of groundwater and setting protective MTs.*" No further elaboration is provided, however. The GSP should describe how sustainable management criteria for chronic lowering of groundwater levels will be updated once the new monitoring for GDEs is in place.

For depletion of interconnected surface water, the GSP considers streamflow along Putah Creek as the governing metric and groundwater levels as a proxy elsewhere. Putah Creek is regulated under the Putah Creek Accord to ensure that there is adequate water to serve the various GDEs found along the creek. The Accord summarizes the required flows in the creek, which will serve as minimum thresholds. For the other smaller surface water features, the minimum thresholds will be the minimum observed groundwater elevations in the historical base period (1991 to 2015). However, no analysis or discussion is presented to describe how the SMC will affect beneficial users, and more specifically GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin.[14] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[15]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[16] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left

[14] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[15] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[16] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,17]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[18] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[19] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP integrates climate change into key inputs (e.g., changes in precipitation and evapotranspiration) of the projected water budget and calculates a sustainable yield based on the projected water budget with climate change incorporated. However, it is unclear if imported water is included in the surface water flow inputs or adjusted for climate change. Furthermore, increased sea level inputs are not accounted for in the projected water budget, despite the GSP's acknowledgement of the potential for higher-salinity surface water intrusion from the Delta (p. 6-18). If the water budgets are incomplete, including the omission of extremely wet and dry scenarios and the omission of projected climate change effects on imported water flow and sea level (due to reduced availability of freshwater due to sea level rise related saltwater intrusion), then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

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[17] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[18] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[19] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

RECOMMENDATIONS
● Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions. ● Incorporate climate change into imported water inputs and sea level inputs for the projected water budget. ● Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs and domestic wells in the subbasin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[20]

Figure 6-1a (Groundwater Level RMS Location Map-Alluvial Aquifer and Upper Tehama Zone) shows insufficient representation of DACs and GDEs for shallow groundwater elevation monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater.

Figure 6-6 (Groundwater Quality RMS Location Map) shows insufficient representation of DACs and drinking water users for water quality monitoring, due to coverage of these areas by wells of unknown depth. We recognize that the GSP acknowledges this data gap with respect to screening depth of the water quality RMS. The GSP states (p. 6-41): *"With other sustainability indicators wells with unknown constructions were avoided, however due to the limited water quality monitoring that has occurred thus far in the Subbasin this GSP is including unknown wells construct wells with the thought in the future to well depth and or screen intervals will be determined. These locations are representative of the overall Subbasin conditions because they are spatially distributed throughout the Subbasin both vertically and laterally with consideration of the spatial distribution of reliance on groundwater by different beneficial users in the Subbasin."* We recommend that this data gap is more fully discussed and that the GSP propose specific measures and a timeline to fill this data gap.

RECOMMENDATIONS
● Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify monitored areas and assess the adequacy of the monitoring network. ● Increase the number of RMSs in the shallow aquifer across the subbasin as needed to map ISWs and adequately monitor all groundwater condition indicators across the

[20] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMSs.

- Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.

- Discuss the well construction data gap in more detail and propose specific measures and a timeline to fill this data gap.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **incomplete**, due to the failure to fully describe the explicit benefits or impacts to DACs from identified recharge projects (Section 8.2.1). Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

We commend the GSA for including projects and management actions with explicit environmental benefits, such as multi-benefit recharge projects that support flood risk reduction, water quality improvement, climate change adaptation, and ecosystem enhancement in the subbasin, as developed with support and guidelines from The Nature Conservancy.

We note that the plan does not include a domestic well mitigation program to avoid significant and unreasonable loss of drinking water. We strongly recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation.

RECOMMENDATIONS

- Describe the explicit benefits or impacts to DACs from identified projects, including the Multi-Benefit Recharge projects identified in Section 8.2.1.

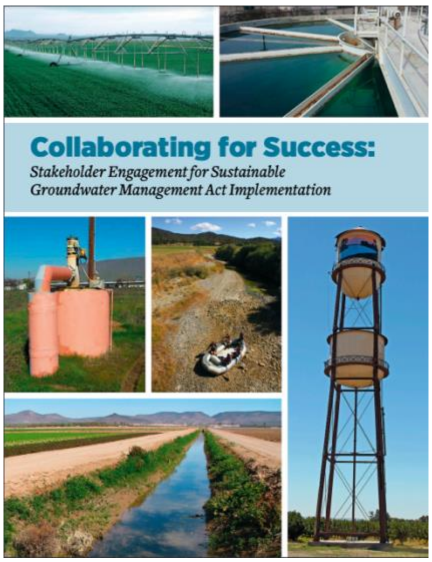
- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

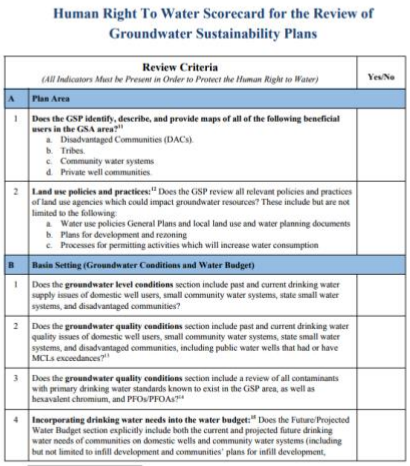
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

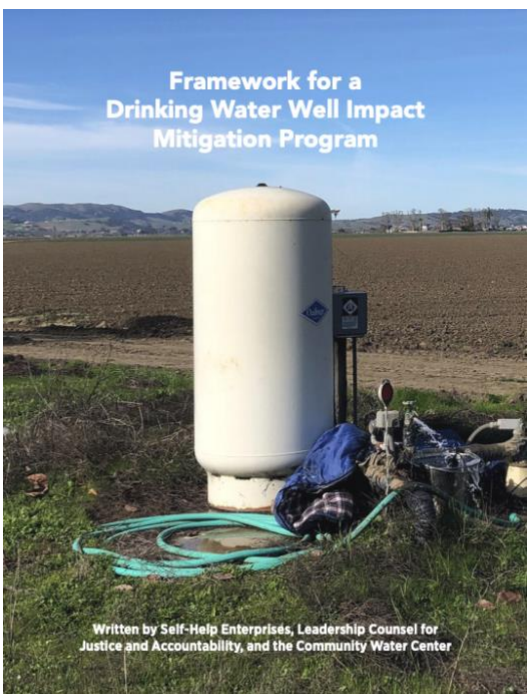


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

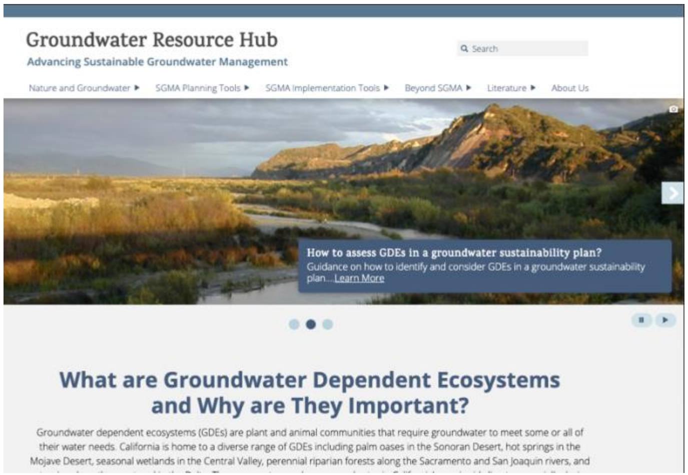
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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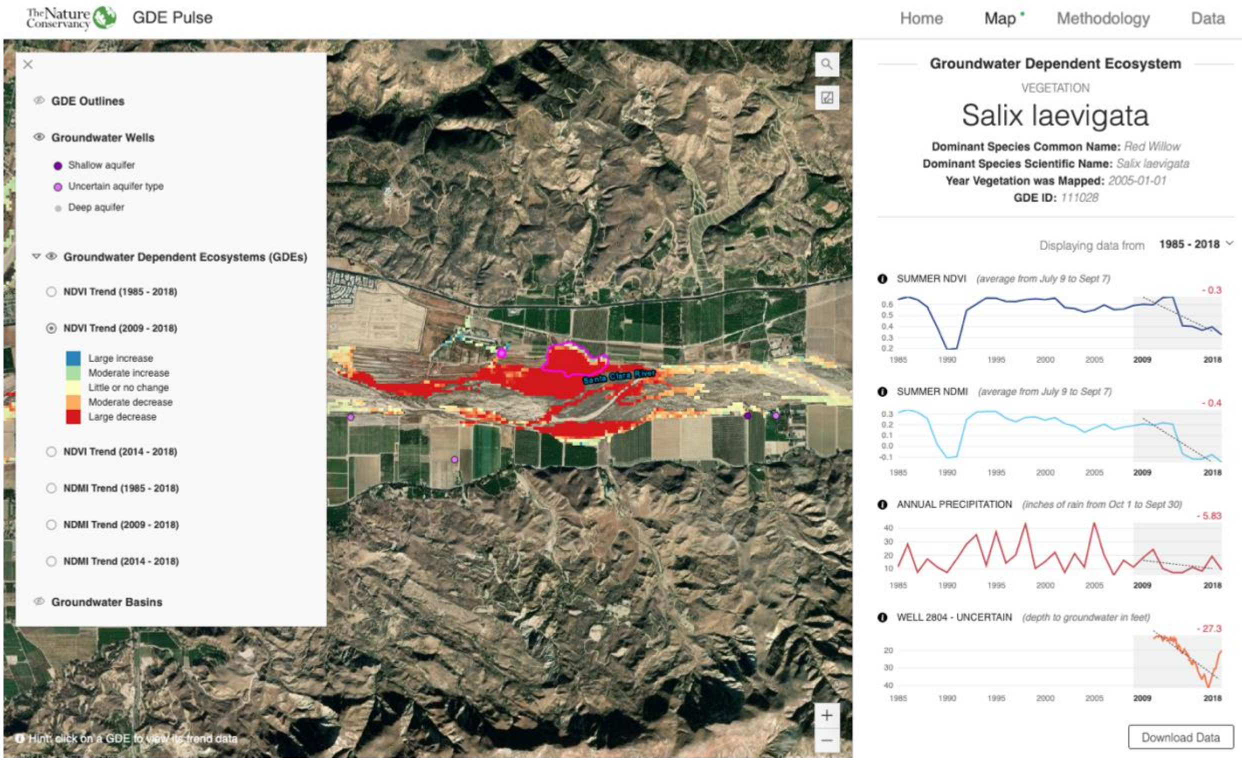
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](https://) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

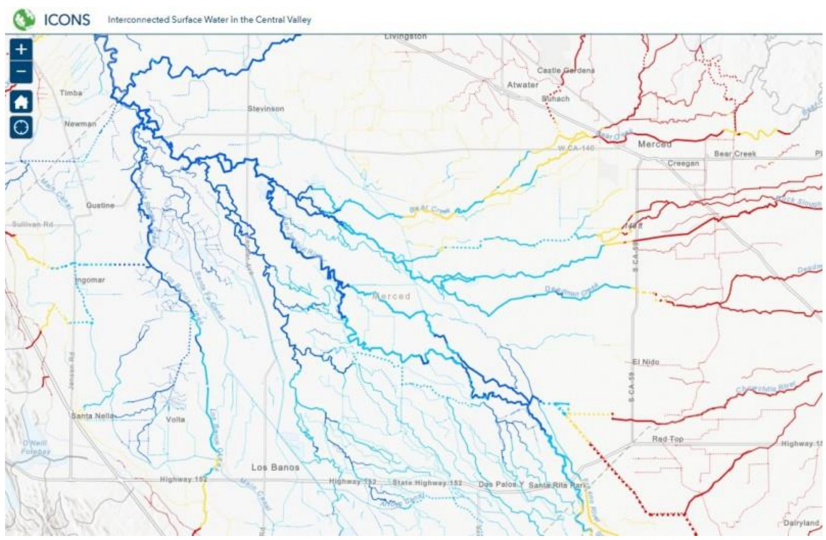
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Solano Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result “depletion of interconnected surface waters”, Attachment C provides a list of freshwater species located in the Solano Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife’s BIOS[2] as well as on The Nature Conservancy’s science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Ardea herodias	Great Blue Heron			
Geothlypis trichas sinuosa	Saltmarsh Common Yellowthroat	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Laterallus jamaicensis coturniculus	California Black Rail	Bird of Conservation Concern	Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Aythya affinis	Lesser Scaup			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Candidate - Threatened	Endangered	
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mycteria americana	Wood Stork		Special Concern	BSSC - First priority
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			

Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta conservatio	Conservancy Fairy Shrimp	Endangered	Special	IUCN - Endangered
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Branchinecta mesovallensis	Midvalley Fairy Shrimp		Special	
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
Americorophium spinicorne				Not on any status lists
Americorophium spp.	Americorophium spp.			
Americorophium stimpsoni				Not on any status lists
Cambaridae fam.	Cambaridae fam.			
Crangonyx spp.	Crangonyx spp.			
Cyprididae fam.	Cyprididae fam.			
Cyzicus californicus	California Clam Shrimp			
Gammarus spp.	Gammarus spp.			
Hyalella spp.	Hyalella spp.			

Pacifastacus leniusculus leniusculus	Signal Crayfish			
Ramellogammarus spp.	Ramellogammarus spp.			
FISH				
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endangered	Endangered	Vulnerable - Moyle 2013
Pogonichthys macrolepidotus	Sacramento splittail		Special Concern	Vulnerable - Moyle 2013
Spirinchus thaleichthys	Longfin smelt	Candidate	Threatened	Vulnerable - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Dicamptodon ensatus	California Giant Salamander			ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
Pseudacris regilla	Northern Pacific Chorus Frog			
INSECTS & OTHER INVERTS				
Hydrochara rickseckeri	Ricksecker's Water Scavenger Beetle		Special	
Ablabesmyia spp.	Ablabesmyia spp.			
Anax junius	Common Green Darner			
Apedilum spp.	Apedilum spp.			
Argia agrioides	California Dancer			
Argia emma	Emma's Dancer			
Argia spp.	Argia spp.			

Argia vivida	Vivid Dancer			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Caenis bajaensis	A Mayfly			
Callibaetis spp.	Callibaetis spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Cladopelma spp.	Cladopelma spp.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corixidae fam.	Corixidae fam.			
Cricotopus nostocicola				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Cryptotendipes spp.	Cryptotendipes spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Dubiraphia spp.	Dubiraphia spp.			
Enallagma carunculatum	Tule Bluet			
Erythemis collocata	Western Pondhawk			
Gerridae fam.	Gerridae fam.			
Gomphidae fam.	Gomphidae fam.			
Gomphus kurilis	Pacific Clubtail			
Gomphus spp.	Gomphus spp.			
Harnischia spp.	Harnischia spp.			
Hetaerina americana	American Rubyspot			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Ischnura perparva	Western Forktail			
Lepidostoma spp.	Lepidostoma spp.			
Libellula forensis	Eight-spotted Skimmer			
Libellula luctuosa	Widow Skimmer			
Libellula pulchella	Twelve-spotted Skimmer			
Libellula saturata	Flame Skimmer			
Libellulidae fam.	Libellulidae fam.			
Liodessus obscurellus				Not on any status lists
Macromia magnifica	Western River Cruiser			
Microchironomus spp.	Microchironomus spp.			
Mideopsis spp.	Mideopsis spp.			
Oecetis spp.	Oecetis spp.			
Oxyethira spp.	Oxyethira spp.			

Pachydiplax longipennis	Blue Dasher			
Paracladopelma spp.	Paracladopelma spp.			
Paralauterborniella nigrohalteris				Not on any status lists
Parametriocnemus spp.	Parametriocnemus spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Paratendipes spp.	Paratendipes spp.			
Pentaneura spp.	Pentaneura spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Plathemis lydia	Common Whitetail			
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Psectrocladius spp.	Psectrocladius spp.			
Psectrotanypus spp.	Psectrotanypus spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Sialis spp.	Sialis spp.			
Sigara spp.	Sigara spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sympetrum corruptum	Variegated Meadowhawk			
Tanypus spp.	Tanypus spp.			
Tanytarsus spp.	Tanytarsus spp.			
Telebasis salva	Desert Firetail			
Tipulidae fam.	Tipulidae fam.			
Tramea lacerata	Black Saddlebags			
Trichocorixa calva				Not on any status lists
Trichocorixa spp.	Trichocorixa spp.			
Unionicolidae fam.	Unionicolidae fam.			
Veliidae fam.	Veliidae fam.			
Zoniagrion exclamationis	Exclamation Damsel			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Ferrissia spp.	Ferrissia spp.			
Fluminicola spp.	Fluminicola spp.			

Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus spp.	Gyraulus spp.			
Helisoma spp.	Helisoma spp.			
Hydrobiidae fam.	Hydrobiidae fam.			
Juga occata	Scalloped Juga		Special	E
Lymnaea stagnalis	Swamp Lymnaea			Not on any status lists
Margaritifera falcata	Western Pearlshell		Special	
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Planorbidae fam.	Planorbidae fam.			
Sphaeriidae fam.	Sphaeriidae fam.			
Tryonia spp.	Tryonia spp.			
PLANTS				
Downingia pusilla	Dwarf Downingia		Special	CRPR - 2B.2
Hibiscus lasiocarpos occidentalis			Special	CRPR - 1B.2
Lasthenia conjugens	Contra Costa Goldfields	Endangered	Special	CRPR - 1B.1
Legenere limosa	False Venus'-looking-glass		Special	CRPR - 1B.1
Lilaeopsis masonii	Mason's Lilaeopsis		Special	CRPR - 1B.1
Limosella australis	NA		Special	CRPR - 2B.1
Navarretia leucocephala bakeri	Baker's Navarretia		Special	CRPR - 1B.1
Neostapfia colusana	Colusa Grass	Threatened	Endangered	CRPR - 1B.1
Sagittaria sanfordii	Sanford's Arrowhead		Special	CRPR - 1B.2
Symphyotrichum lentum	Suisun Marsh Aster		Special	CRPR - 1B.2
Tuctoria mucronata	Mucronate Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Alisma triviale	Northern Water-plantain			
Alnus rhombifolia	White Alder			
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Ammannia robusta	Grand Redstem			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla filiculoides	NA			
Bacopa rotundifolia	NA			
Bidens laevis	Smooth Bur-marigold			
Bidens vulgata	NA			
Boehmeria cylindrica	NA			Not on any status lists
Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			

Cephalanthus occidentalis	Common Buttonbush			
Cicendia quadrangularis	Oregon Microcala			
Cicuta maculata bolanderi	Bolander's Water-hemlock		Special	CRPR - 2B.1
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Crassula solieri	NA			Not on any status lists
Crypsis vaginiflora	NA			
Cyperus erythrorhizos	Red-root Flatsedge			
Damasonium californicum				Not on any status lists
Downingia bella	Hoover's Downingia			
Downingia bicornuta	NA			
Downingia concolor	NA			
Downingia cuspidata	Toothed Calicoflower			
Downingia insignis	Parti-color Downingia			
Downingia ornatissima	NA			
Downingia pulchella	Flat-face Downingia			
Elatine californica	California Waterwort			
Elatine rubella	Southwestern Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium aristulatum aristulatum	California Eryngo			
Eryngium articulatum	Jointed Coyote-thistle			
Eryngium castrense	Great Valley Eryngo			
Eryngium jepsonii	NA			Not on any status lists
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Gratiola heterosepala	Boggs Lake Hedge-hyssop		Endangered	CRPR - 1B.2
Helenium bigelovii	Bigelow's Sneezeweed			
Helenium puberulum	Rosilla			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Isoetes orcuttii	NA			
Isolepis cernua	Low Bulrush			
Juncus acutus leopoldii	Spiny Rush		Special	CRPR - 4.2

Juncus diffusissimus	NA			
Juncus effusus effusus	NA			
Juncus effusus pacificus				
Juncus phaeocephalus paniculatus	Brownhead Rush			
Juncus uncialis	Inch-high Rush			
Juncus xiphioides	Iris-leaf Rush			
Lasthenia fremontii	Fremont's Goldfields			
Lathyrus jepsonii	NA		Special	CRPR - 1B.2
Leersia oryzoides	Rice Cutgrass			
Lemna turionifera	Turion Duckweed			
Lepidium oxycarpum	Sharp-pod Pepper-grass			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limnanthes douglasii nivea	Douglas' Meadowfoam			
Limnanthes douglasii rosea	Douglas' Meadowfoam			
Ludwigia hexapetala	NA			Not on any status lists
Ludwigia palustris	Marsh Seedbox			
Ludwigia peploides peploides	NA			Not on any status lists
Lycopus americanus	American Bugleweed			
Lythrum californicum	California Loosestrife			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Mimulus latidens	Broad-tooth Monkeyflower			
Mimulus tricolor	Tricolor Monkeyflower			
Montia fontana fontana	Fountain Miner's-lettuce			
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Myriophyllum aquaticum	NA			
Navarretia cotulifolia	Cotula Navarretia			
Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Oenanthe sarmentosa	Water-parsley			
Orcuttia viscida	Sacramento Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Paspalum distichum	Joint Paspalum			

Persicaria amphibia				Not on any status lists
Persicaria hydropiperoides				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phalaris arundinacea	Reed Canarygrass			
Phragmites australis australis	Common Reed			
Phyla lanceolata	Fog-fruit			
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plagiobothrys undulatus	NA			Not on any status lists
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pleuropogon californicus californicus				Not on any status lists
Pluchea odorata odorata	Scented Conyza			
Pogogyne douglasii	NA			
Pogogyne zizyphoroides				Not on any status lists
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus brevissimus multiflorus	Delta Woolly Marbles		Special	CRPR - 4.2
Psilocarphus oregonus	Oregon Woolly-heads			
Psilocarphus tenellus	NA			
Puccinellia nuttalliana	Nuttall's Alkali Grass			
Puccinellia simplex	Little Alkali Grass			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rorippa palustris palustris	Bog Yellowcress			
Rumex conglomeratus	NA			
Rumex salicifolius salicifolius	Willow Dock			

Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Salix babylonica	NA			
Salix exigua exigua	Narrowleaf Willow			
Salix exigua hindsiana				Not on any status lists
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Samolus parviflorus	NA			Not on any status lists
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus americanus	Three-square Bulrush			
Schoenoplectus californicus	California Bulrush			
Senecio hydrophilus	Great Swamp Ragwort			
Sidalcea hirsuta	Hairy Checker-mallow			
Sinapis alba	NA			
Spartina foliosa	California Cordgrass			
Stachys ajugoides	Bugle Hedge-nettle			
Stachys albens	White-stem Hedge-nettle			
Suaeda calceoliformis	American Sea-blite			
Triglochin maritima	Common Bog Arrow-grass			
Triglochin scilloides	NA			Not on any status lists
Typha latifolia	Broadleaf Cattail			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

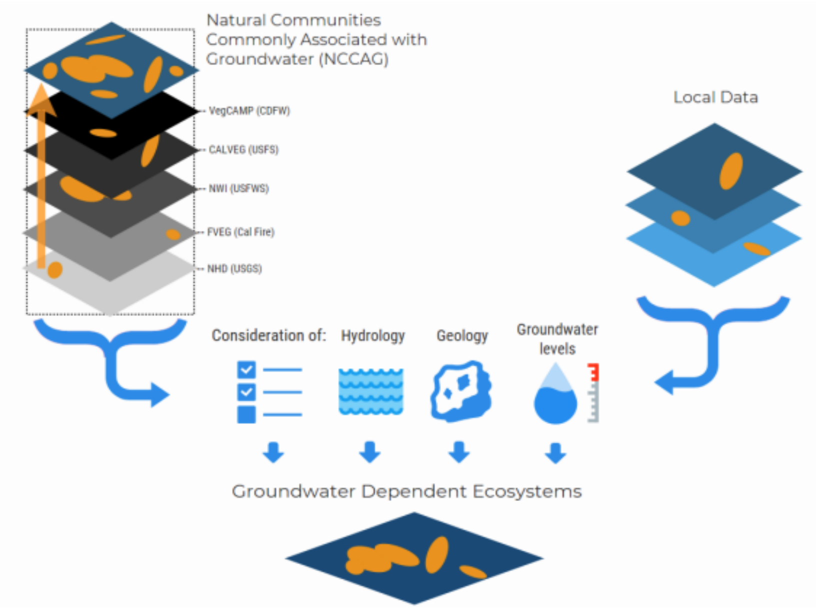


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

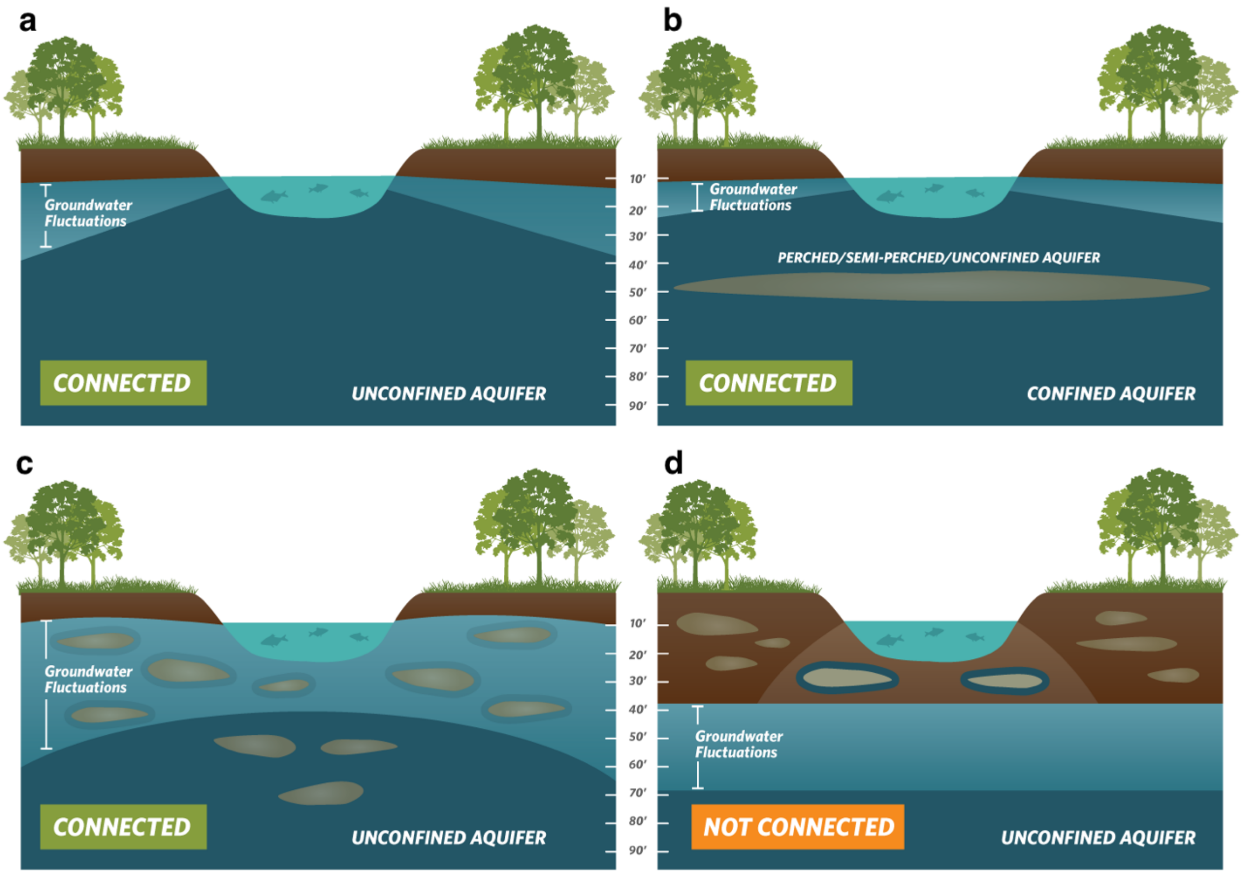

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

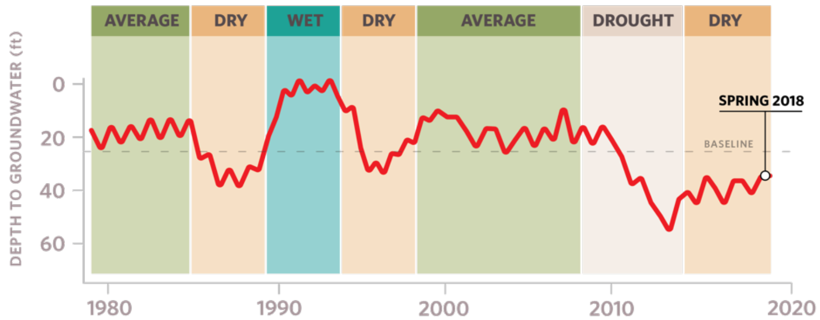

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

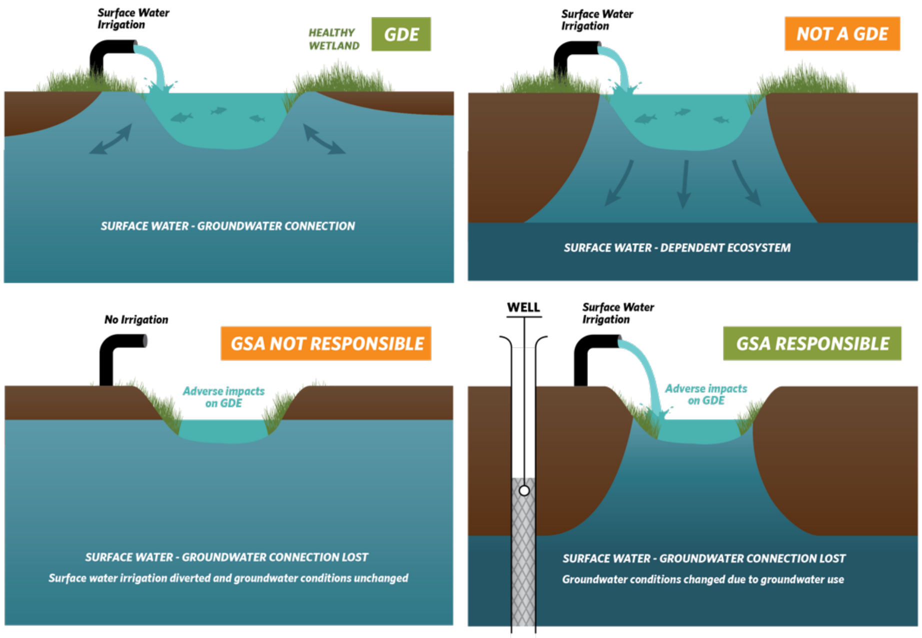

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

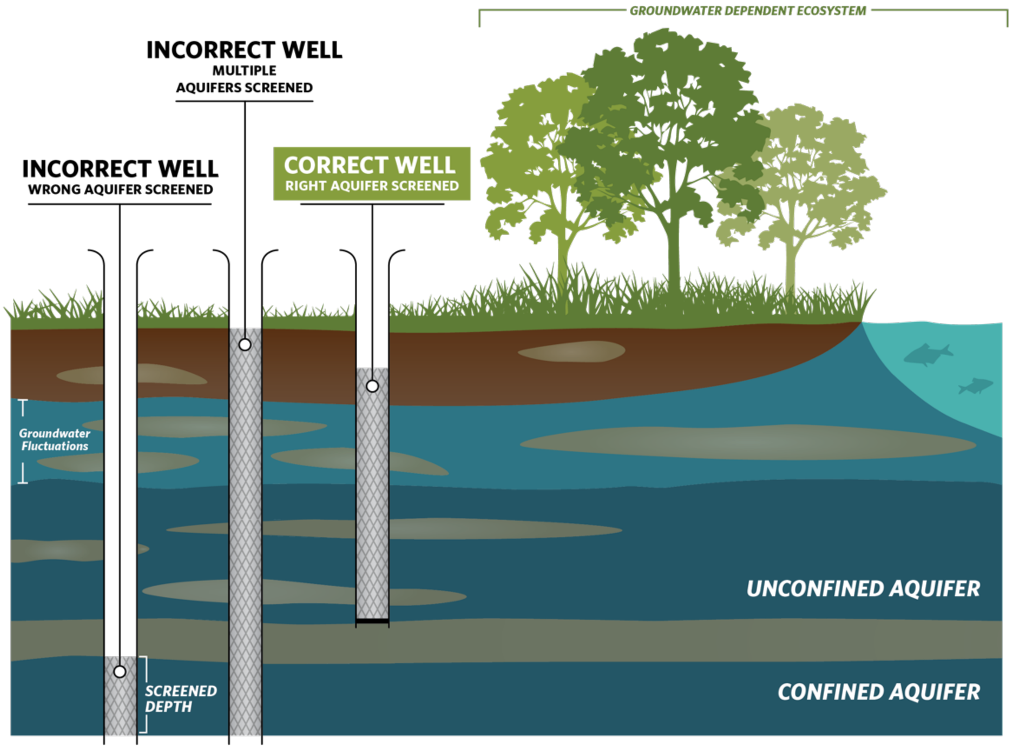

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

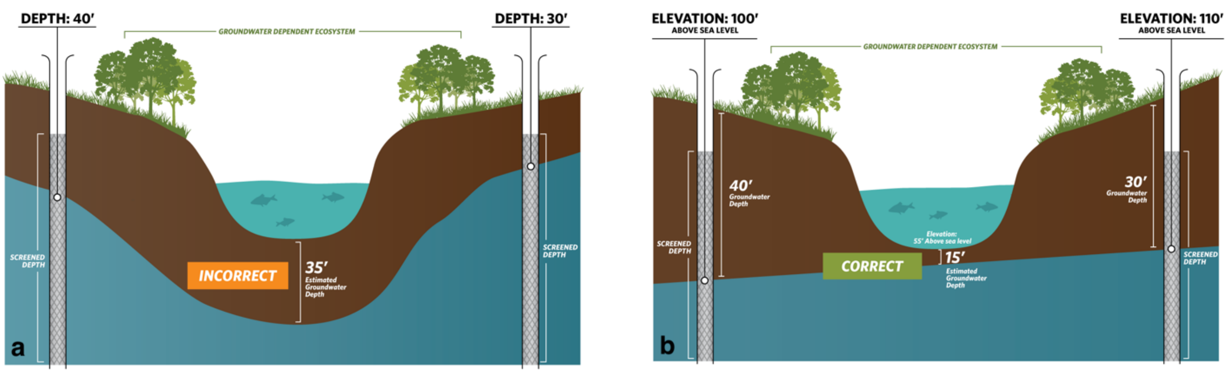

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

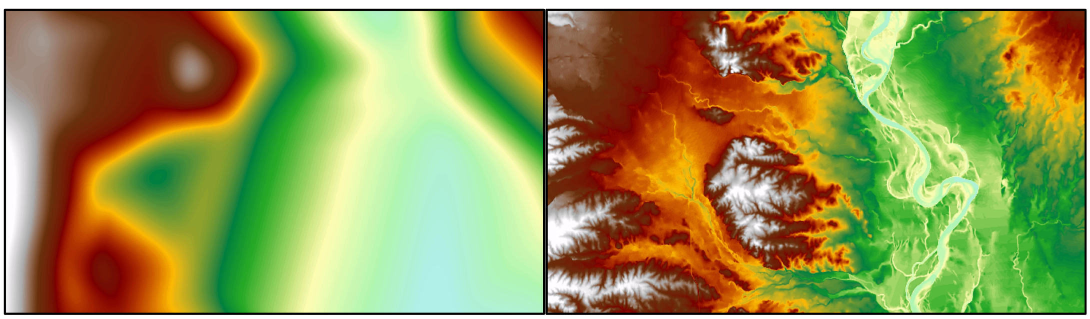

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

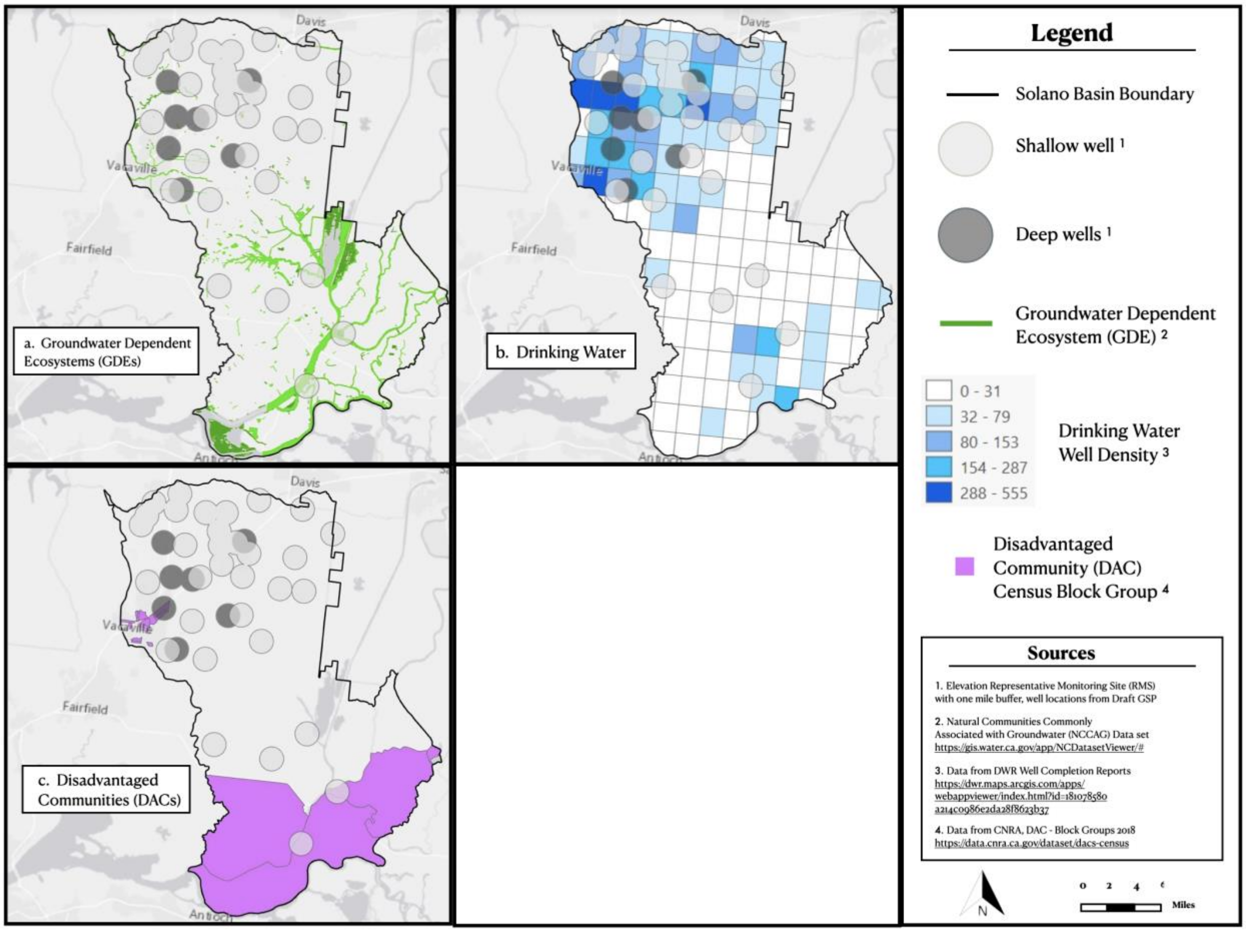

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

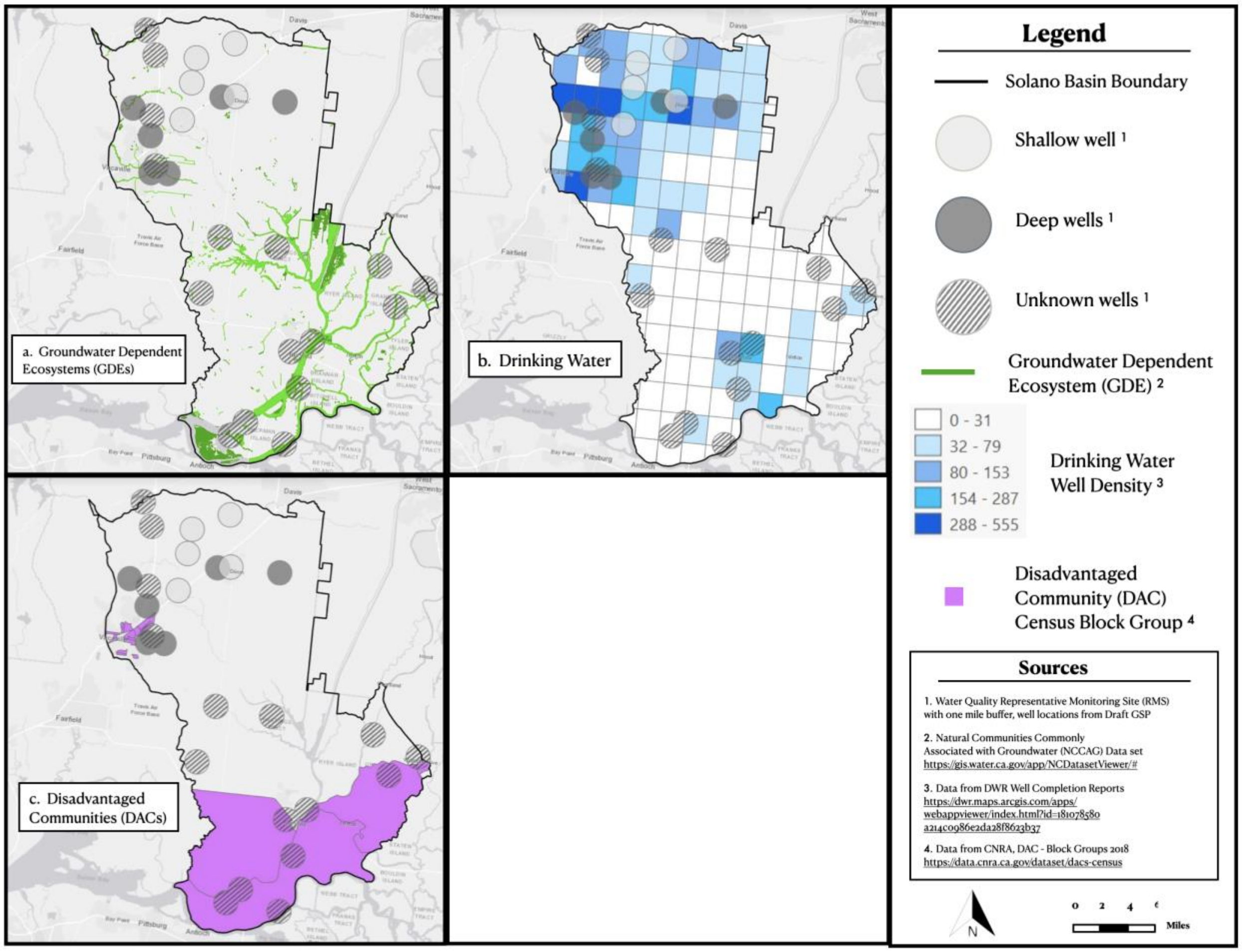

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

October 31, 2021

Sonoma Valley GSA

Submitted via web: https://sonomavalleygroundwater.org/document-comments/

Re: Public Comment Letter for Sonoma Valley Groundwater Subbasin Draft GSP

Dear Ann DuBay,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Sonoma Valley Groundwater Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Sonoma Valley Groundwater Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Sonoma Valley Groundwater Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. We note the following deficiencies with the identification of these key beneficial users:

- While the plan identifies DACs by name, it fails to map the locations of DACs or provide the population of each DAC. The plan fails to explicitly identify the population dependent on groundwater as their source of drinking water in the subbasin.

- The GSP includes a map of water wells in the subbasin (Figure 2-6). However, the map groups all wells together and does not differentiate between well types such as domestic, irrigation, or industrial wells. Additionally, the plan fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide a map of DACs and more information about the population of each identified DAC. Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). • Include a domestic well density map for the subbasin.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

- Include a map showing domestic well locations and average well depth across the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **insufficient**. Like the Santa Rosa Plain GSP, the Sonoma Valley GSP uses a multiple-lines-of-evidence approach to determine whether stream reaches in the subbasin are interconnected (but without the point system). The GSP states (p. 3-86): *"Reaches of interconnected surface water in the watershed are identified through several different lines of evidence, including (1) results of seepage-run monitoring, (2) frequency of observed or measured streamflow, (3) comparison of interpolated groundwater levels within the shallow aquifer system and streambed elevations, and (4) high-frequency groundwater-level observations from shallow monitoring wells located near streams."*

The GSP presents analysis and figures illustrating each line of evidence. However, conclusions for the ISW assessment, as appearing on Figure 3-23 (Interconnected Surface Water and Potential Surface Water Depletion Representative Monitoring Point Locations) appear to neglect some of the analysis. For example, Figure 3-20 (Depth to Groundwater Along Stream Reaches, Spring 2015) shows depth to groundwater as 0 feet on stream segments in the south to southeastern portion of the subbasin in the Napa Slough area, but these same reaches are not considered ISW on Figure 3-23. Note the regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

Appendix 3-D provides further analysis of interconnected surface water based on shallow well data. In this appendix or elsewhere in the GSP, it would be helpful to see the depth to groundwater contours used to create Figure 3-20 (Depth to Groundwater Along Stream Reaches, Spring 2015) and depth to groundwater contours at other time periods as data is available. Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs. The use of one date does not reflect the temporal (seasonal and interannual) variability inherent in California's climate.

RECOMMENDATIONS

- Consider stream reaches with connection for any percentage of time as interconnected. On the map of streams in the subbasin, clearly labeled reaches as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.

- Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.
- Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **incomplete**. The GSP maps GDEs using the Sonoma County Veg Map, which we agree is the best available data for the subbasin. To identify where the potential GDEs are likely to have connection with groundwater, the rooting depths of common tree species were compared to available depth-to-groundwater data. The GSP states (p. 3-102): *"The DTW mapping used available contoured springtime datasets for the shallow aquifer system (from 2015 and 2016) and high-resolution LiDAR data. To address GDE Work Group member concerns that groundwater levels were generally at lower levels in 2015 and 2016 due to dry conditions, minor adjustments in some areas were made to incorporate the shallowest depth-to-water on record for each well based on review of all available data from 2005 to 2020."* However, no further details on the available data from 2005 to 2020 was provided.

The GSP states (p. 3-102): *"Following guidance from TNC, potential vegetation GDEs were mapped for areas with DTW of 30 feet or less to incorporate the potential rooting depths of oak trees (TNC 2018)."* If Valley Oaks exist in the subbasin, we recommend instead that an 80-foot depth-to-groundwater threshold be used when inferring whether Valley Oak polygons in the Veg Map derived potential GDE map are likely reliant on groundwater. This recommendation is based on a recent correction in TNC's rooting depth database,[2] after finding a typo in the max rooting depth units for Valley Oak. This resulted in a specific change in the max rooting depth of Valley Oak from 24 feet to 24 meters (80 feet). For all other phreatophytes, we continue to recommend that a 30-foot depth-to-groundwater threshold be used when inferring whether all other vegetation polygons are likely reliant on groundwater.

RECOMMENDATIONS

- Discuss available shallow groundwater data. Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around Veg Map derived potential GDE polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the Veg Map derived potential GDE map are supported by groundwater in an aquifer.
- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as Valley Oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be

[2] TNC. 2021. Plant Rooting Depth Database. Available at: https://groundwaterresourcehub.org/sgma-tools/gde-rooting-depths-database-for-gdes/

used if these species are present in the subbasin. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether Valley Oak polygons are connected to groundwater.

- Further discuss data gaps for GDEs, including specific plans and locations for additional shallow monitoring wells.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[3,4] The integration of native vegetation into the water budget is **insufficient**. The water budget includes a separate item for evapotranspiration, but combines crop, native vegetation, and riparian evapotranspiration into one term. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the subbasin.

RECOMMENDATION

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.
- State whether or not there are managed wetlands in the subbasin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP Development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Community Engagement Plan (Appendix 1-E).[5]

The GSP states that the GSA Advisory Committee includes representatives from the environmental stakeholder community, and that the Advisory Committee will continue to meet

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[3] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[4] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[5] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

during GSP implementation. However, we note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement through monthly informational emails, the GSA website, public forums, presentations to stakeholder groups within the subbasin, a rural community engagement program, and GSA Board, Advisory Committee and community meetings. There is no explicit identification of a DAC representative on the Advisory Committee or other outreach targeted to DACs and drinking water users.

- Other than representation on the Advisory Committee, outreach to environmental stakeholders is described in general terms. The role that the Advisory Committee plays during the GSP *implementation* process is unclear.

RECOMMENDATIONS

- In the Community Engagement Plan, describe active and targeted outreach to engage DACs and domestic well owners throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Provide more information on the role of the Advisory Committee during the GSP implementation process.

- Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the subbasin within the GSP.[6]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[7,8,9]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP presents a well impact study to consider the potential impacts on existing well users (p. 4-15). The well impact study is not clearly presented, but appears to group all wells together (i.e., domestic wells, irrigation wells, public supply wells,

[6] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[7] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[8] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[9] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

and industrial wells), use the 98th percentile shallowest supply well total depth, then add a 'drought factor' as follows (p. 4-16): *"For wells with 10 or more years of historical data, the largest consecutive 4-year decline during historical dry periods was used; For wells with less than 10 years of historical data, the future simulated largest consecutive 4-year decline was used."* The minimum thresholds are then set as follows (p. 4-21): *"MTs for chronic lowering of groundwater levels are set at the more protective of historical low conditions with allowances for future droughts and the depths at which existing wells could be impacted by lowering of groundwater levels."*

Despite this analysis, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold, and whether the undesirable results are consistent with the Human Right to Water policy.[10] In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs when defining undesirable results, nor does it describe how the groundwater level minimum thresholds are consistent with Human Right to Water policy and will avoid significant and unreasonable impacts on DACs.

The GSP identifies arsenic, nitrate, and salinity (measured as total dissolved solids, TDS) as constituents of concern (COCs) for the subbasin. Minimum thresholds are based on a number of supply wells that exceed concentrations of constituents determined to be of concern for the Subbasin. The concentrations are set at the maximum contaminant level (MCL) for arsenic and nitrate and the secondary MCL for TDS. The GSP states (p. 4-38): *"There are other point source contaminants found sporadically in the Subbasin, but these are not regional in extent, are monitored through various other regulatory programs, and consequently SMC are not established in the GSP. Additionally, while boron is identified as a naturally-occurring constituent of interest in Section 3.2.5, boron is not routinely sampled through existing regulatory monitoring programs. New or additional water quality constituents may be identified as potential COCs applicable to the GSP implementation activities through routine consultation and information sharing with other regulatory agencies. The GSA would then consider adding potential COCs and assigning SMC during the 5-year GSP updates."* However, SMC should be established for all COCs in the subbasin impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

The GSP only includes a very general discussion of impacts to drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs and drinking water users.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and drinking water users when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

Degraded Water Quality

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality. For specific guidance on how to

[10] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[11]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that are impacted by groundwater use and/or management. Ensure they align with drinking water standards.[12]

Groundwater Dependent Ecosystems and Interconnected Surface Waters

For chronic lowering of groundwater levels, when describing effects on beneficial uses and users (Section 4.5.2.4) the GSP states (p. 4-21): *"Maintaining groundwater near or above historical levels will help maintain the interconnected nature of groundwater and surface water in the Subbasin. This will protect GDE habitat and generally benefit environmental land uses and users."* No analysis or discussion is provided in the GSP that describes impacts on GDEs or establishes SMC for GDEs that are directly dependent on groundwater. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC for chronic lowering of groundwater levels.

For depletion of interconnected surface water, Appendix 4-C (Development of Sustainable Management Criteria of Interconnected Surface Water) describes the methodology for establishing SMC. The appendix states (p. 3): *"Based on input from the Depletion of Interconnected Surface Water Work Group, as well from the Sonoma Valley GSA Advisory Committee and Board, it was determined that MT values at RMP locations should be sufficiently protective so as to not exceed the average, basin-wide, dry-season (July–September) surface water depletion from pumping that occurred during the three years with the greatest depletion over the 2004–2018 evaluation period. As shown in Fig. 23, the three years with the greatest simulated depletion were 2014, 2015, and 2016. Accordingly, the resultant MT is more protective than if the MT were chosen to reflect the single year with the greatest depletion."* To describe impacts on beneficial users of ISW, the GSP states (p. 4-56): *"If depletions of interconnected surface water were to reach undesirable results, adverse effects could include the reduced ability of the streamflows to meet instream flow requirements for local fisheries and critical habitat in the Subbasin. Reduced surface flows can also negatively affect permitted surface water diversions. Consideration of the above was included as part of SMC development."* However, no analysis or discussion is presented to describe how the SMC will affect beneficial users, and more specifically GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (e.g., steelhead; see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

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[11] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[12] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin.[13] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[14]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[15] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,16]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[17] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more

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[13] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[14] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[15] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[16] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[17] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

on groundwater during times of drought.[18] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using RCP 8.5 and the HadGEM2-ES Global Climate Model. However, the GSP does not consider other extreme climate scenarios in the projected water budget. We encourage you to consider other GCM projections. While HadGEM2-ES may better represent median conditions, other models may better capture other statistics relevant for your basin and may reveal valuable information to account for uncertainty. In addition, the GSP should clearly and transparently incorporate extremely wet and dry scenarios or select more appropriate extreme scenarios for their subbasin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP incorporates climate change into key inputs (e.g., precipitation, evapotranspiration, and sea level rise) of the projected water budget. However, imported water should also be adjusted for climate change and incorporated into the surface water flow inputs of the projected water budget. The sustainable yield is calculated based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of extreme climate scenarios and the omission of projected climate change effects on imported water flow inputs, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Consider other GCM projections to account for uncertainty beyond median statistics.
- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change into surface water flow inputs, including imported water, for the projected water budget.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions around DACs and domestic wells in the subbasin.

Figure 5-4a (Representative Monitoring Point Network for Chronic Lowering of Groundwater Levels – Shallow Aquifer System) and Figure 5-4b (Representative Monitoring Point Network for Chronic Lowering

[18] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

of Groundwater Levels – Deep Aquifer System) shows sufficient representation of DACs and drinking water users for both the shallow and deep aquifer groundwater elevation monitoring.

Figure 5-5 (Representative Monitoring Point Network for Degraded Water Quality) shows insufficient representation of DACs and drinking water users for water quality monitoring. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[19]

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations (specifying whether they are shallow or deep wells) with the locations of DACs, domestic wells, GDEs, and ISWs to clearly identify monitored areas.
- Increase the number of RMPs in the shallow aquifer across the subbasin as needed to adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, and GDEs when identifying new RMPs.
- Ensure groundwater elevation and water quality RMPs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

The management actions described in Section 6.4.1 (Assessment of Potential Policy Options for GSA Consideration) and Section 6.4.2 (Coordination of Farm Plans with GSP Implementation) describe improvement to water quality through sediment runoff mitigation and water quality sampling. The GSP specifically describes projects with benefits to GDEs, including the Stormwater Capture and Recharge Project described in Section 6.2.4. However, the plan fails to identify or describe projects or management action with explicit benefits to DACs or drinking water users, including a domestic well mitigation program.

[19] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document".[20]

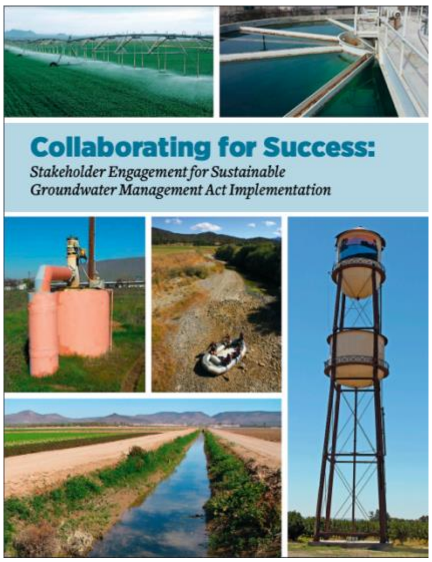
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[20] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

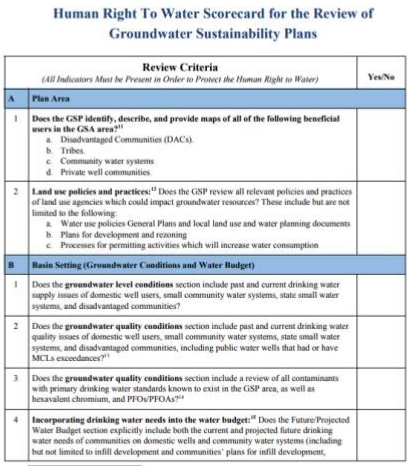
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

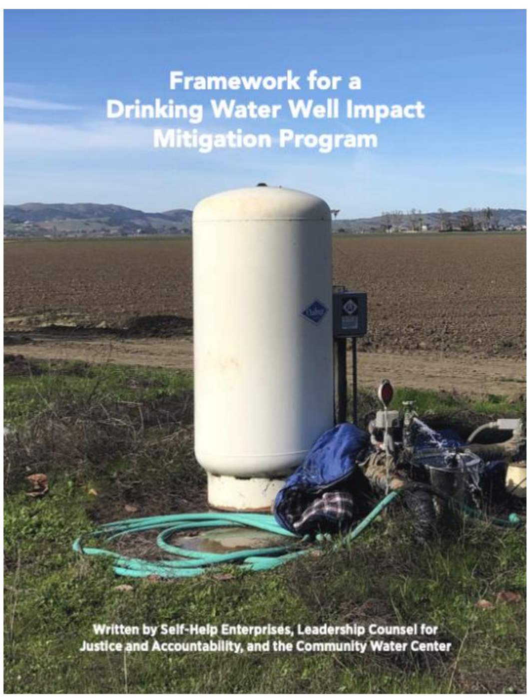


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

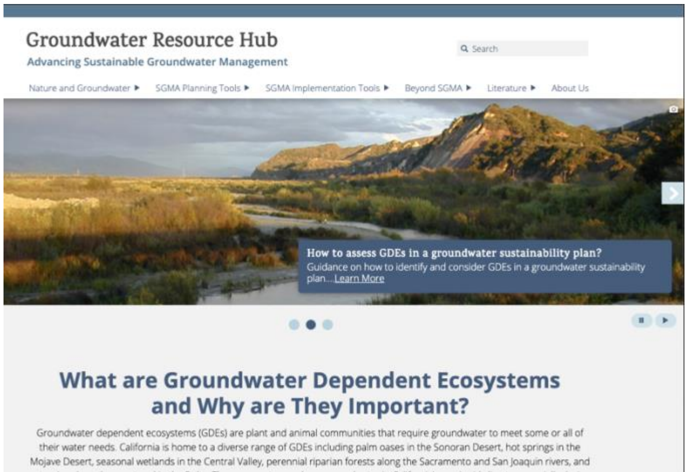
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



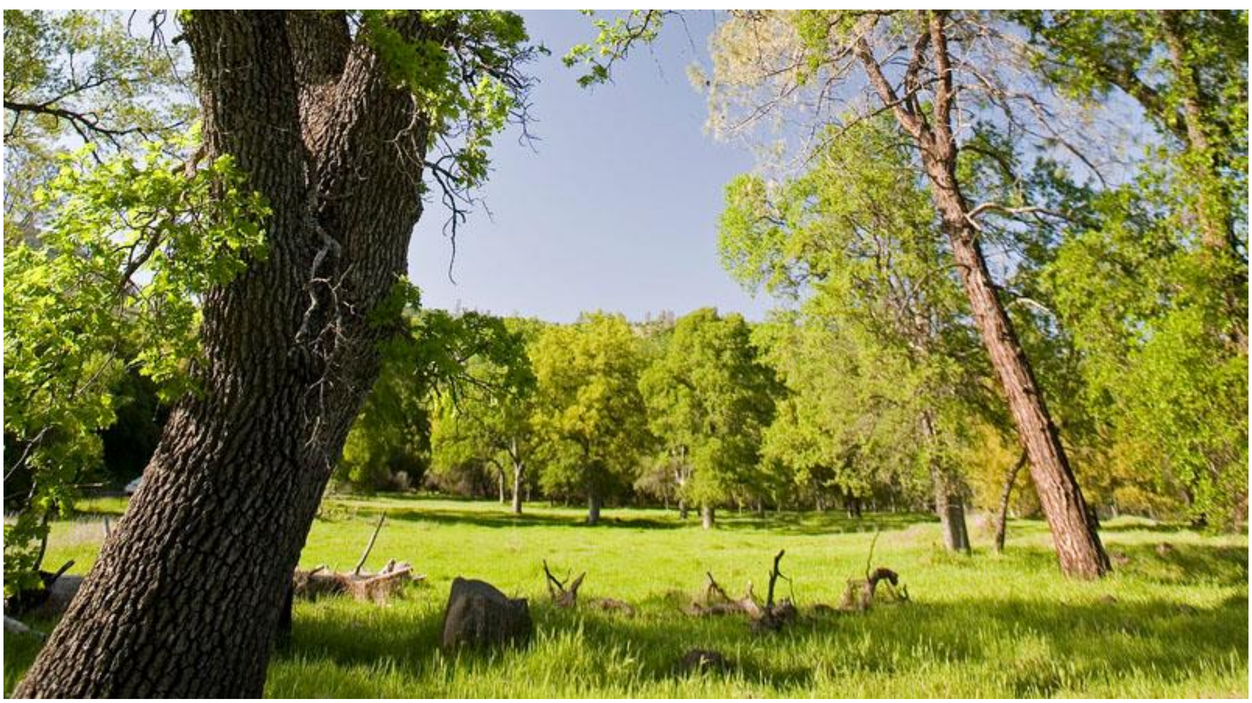
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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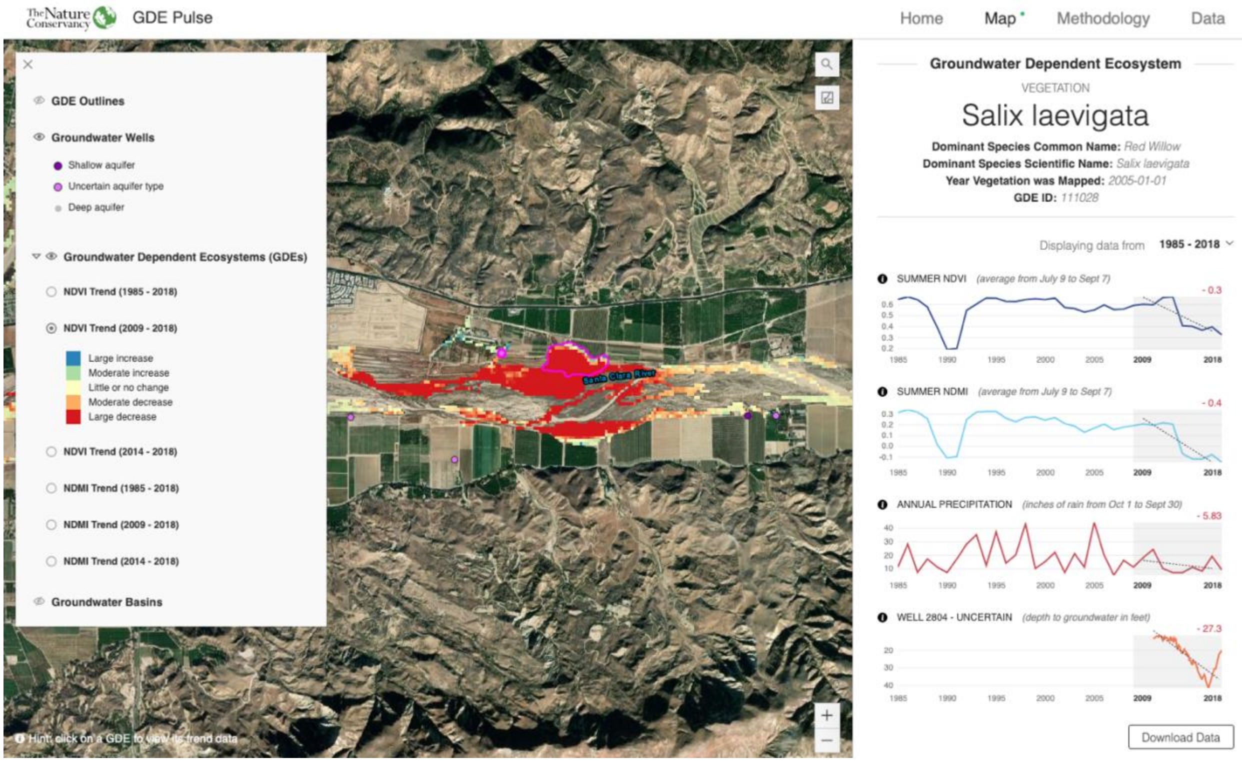
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

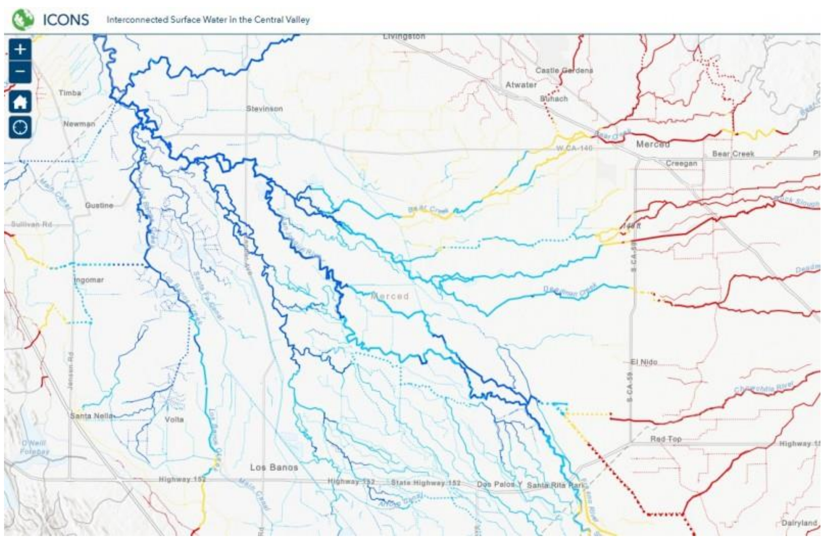
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Sonoma Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Sonoma Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Geothlypis trichas sinuosa	Saltmarsh Common Yellowthroat	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Laterallus jamaicensis coturniculus	California Black Rail	Bird of Conservation Concern	Threatened	
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conserv ation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Geothlypis trichas trichas	Common Yellowthroat			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conserv ation Concern	Endangered	

Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority

CRUSTACEANS				
Syncaris pacifica	California Freshwater Shrimp	Endang ered	Endangered	IUCN - Endang ered
Palaemon macrodactylus				Not on any status lists
FISH				
Acipenser medirostris ssp. 1	Southern green sturgeon	Threate ned	Special Concern	Endang ered - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endang ered	Endangered	Vulnera ble - Moyle 2013
Spirinchus thaleichthys	Longfin smelt	Candida te	Threatened	Vulnera ble - Moyle 2013
Oncorhynchus mykiss - CCC winter	Central California coast winter steelhead	Threate ned	Special	Vulnera ble - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Dicamptodon ensatus	California Giant Salamander			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candida te or Petition Process	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			

Rana aurora	Northern Red-legged Frog		Special Concern	ARSSC
INSECTS & OTHER INVERTS				
Agapetus spp.	Agapetus spp.			
Amiocentrus aspilus	A Caddisfly			
Baetis spp.	Baetis spp.			
Calineuria californica	Western Stone			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Drunella spp.	Drunella spp.			
Epeorus spp.	Epeorus spp.			
Ephemerella maculata	A Mayfly			
Ephemerella spp.	Ephemerella spp.			
Glossosoma spp.	Glossosoma spp.			
Gumaga spp.	Gumaga spp.			
Hydraena spp.	Hydraena spp.			
Hydropsyche spp.	Hydropsyche spp.			
Ironodes spp.	Ironodes spp.			
Isoperla spp.	Isoperla spp.			
Kogotus nonus	Smooth Springfly			
Malenka spp.	Malenka spp.			
Neophylax spp.	Neophylax spp.			
Nixe kennedyi	A Mayfly			
Optioservus spp.	Optioservus spp.			
Ordobrevia nubifera				Not on any status lists
Paraleptophlebia spp.	Paraleptophlebia spp.			
Plathemis lydia	Common Whitetail			
Rhyacophila spp.	Rhyacophila spp.			
Serratella spp.	Serratella spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			

Suwallia spp.	Suwallia spp.			
Wormaldia spp.	Wormaldia spp.			
Zaitzevia spp.	Zaitzevia spp.			
Zapada cinctipes	Common Forestfly			
MAMMALS				
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
PLANTS				
Blennosperma bakeri	Baker's Blennosperma	Endang ered	Endangered	CRPR - 1B.1
Downingia pusilla	Dwarf Downingia		Special	CRPR - 2B.2
Alnus rhombifolia	White Alder			
Alopecurus saccatus	Pacific Foxtail			
Arundo donax	NA			
Baccharis salicina				Not on any status lists
Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche trochlearis	Waste-water Water-starwort			
Calochortus uniflorus	Shortstem Mariposa Lily		Special	CRPR - 4.2
Carex densa	Dense Sedge			
Carex nudata	Torrent Sedge			
Crassula solieri	NA			Not on any status lists
Downingia concolor	NA			
Eleocharis macrostachya	Creeping Spikerush			

Eryngium aristulatum aristulatum	California Eryngo			
Gratiola ebracteata	Bractless Hedge-hyssop			
Isoetes howellii	NA			
Juncus effusus pacificus				
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Mimulus guttatus	Common Large Monkeyflower			
Pleuropogon californicus californicus				Not on any status lists
Pogogyne douglasii	NA			
Ranunculus lobbii	Lobb's Water Buttercup		Special	CRPR - 4.2
Ranunculus pusillus pusillus	Pursh's Buttercup			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Stachys ajugoides	Bugle Hedge-nettle			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

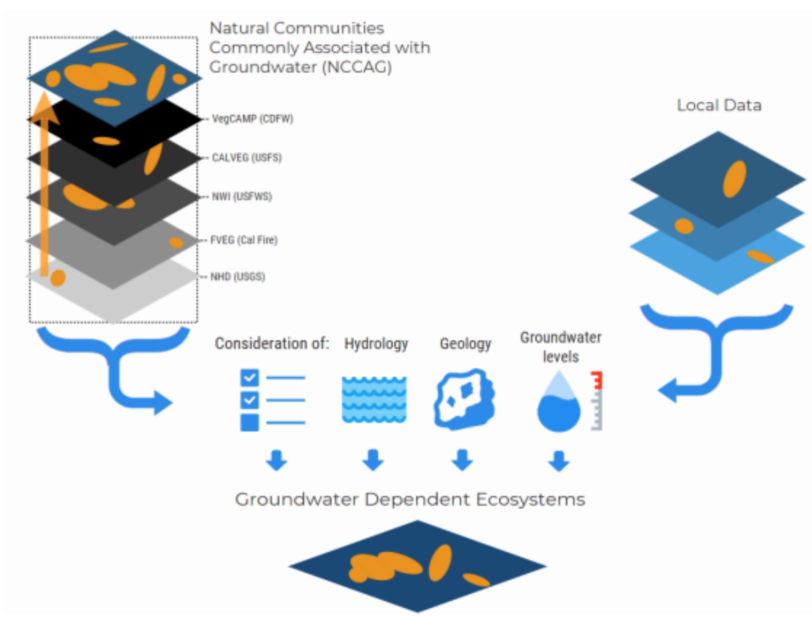


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

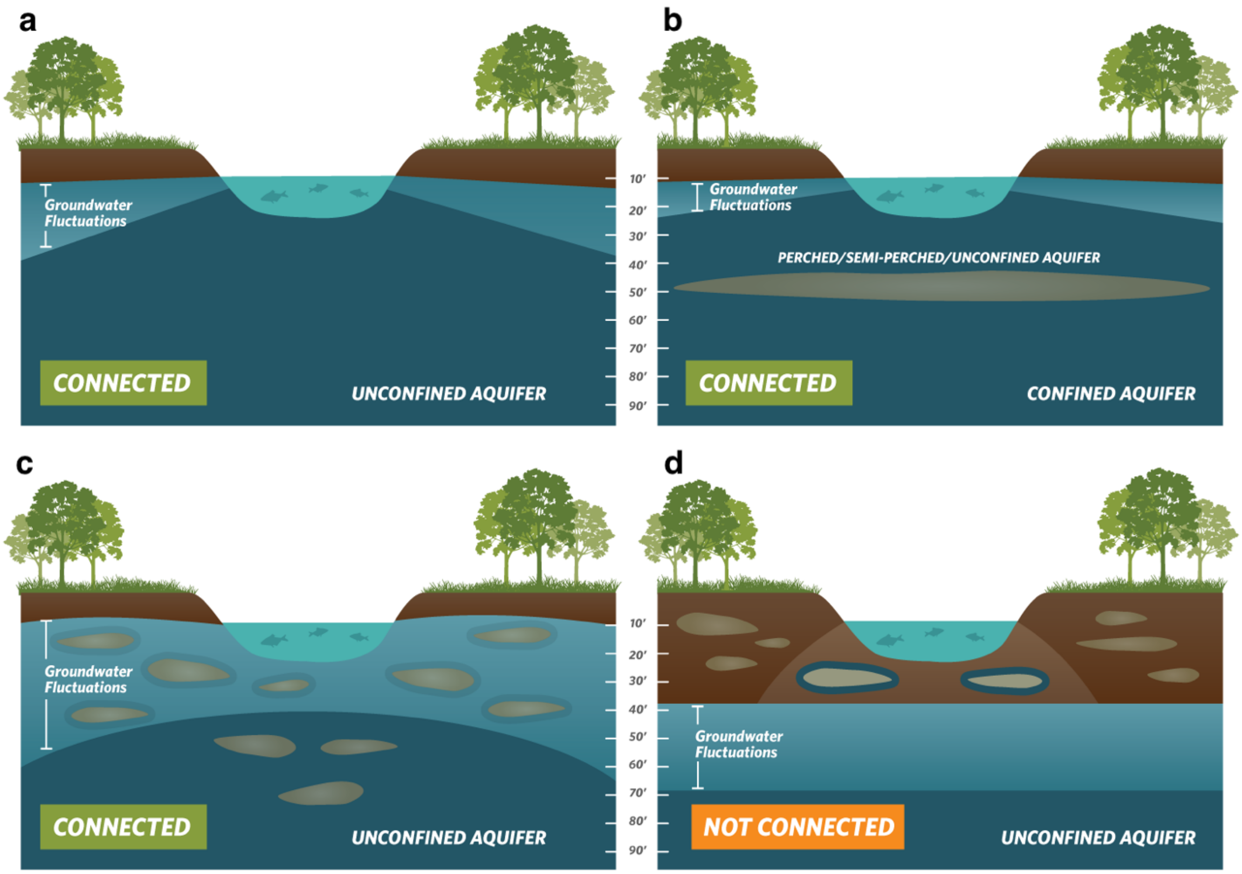

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

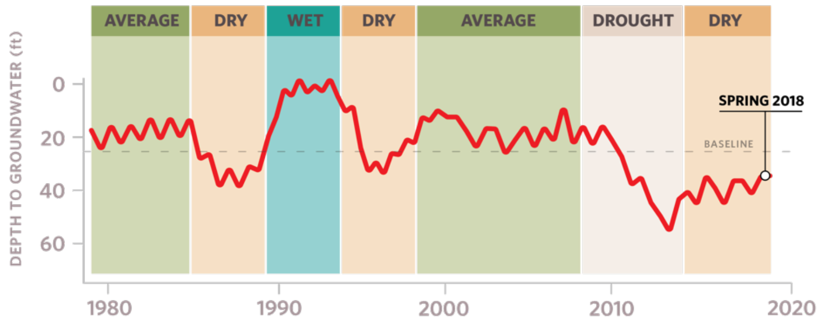

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

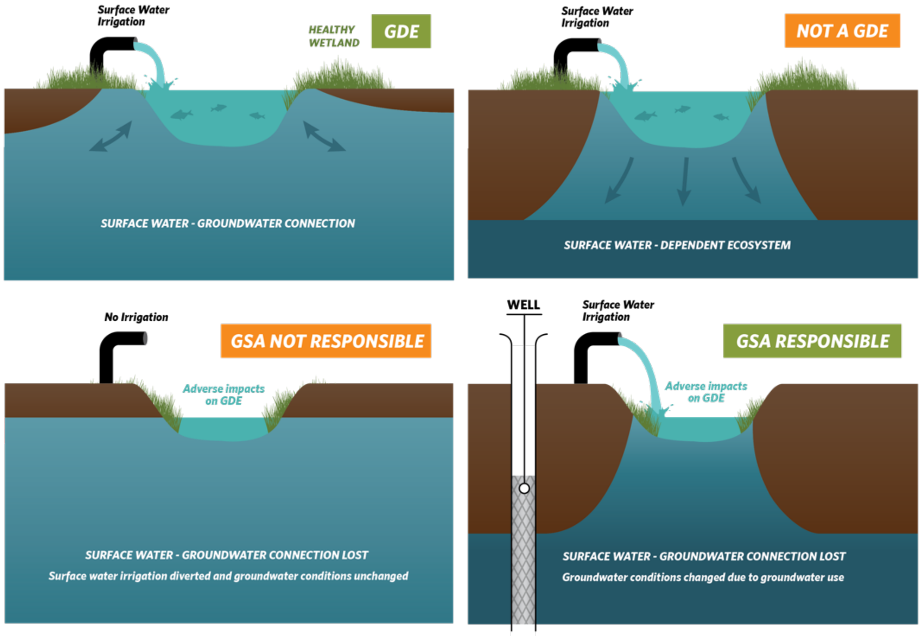

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

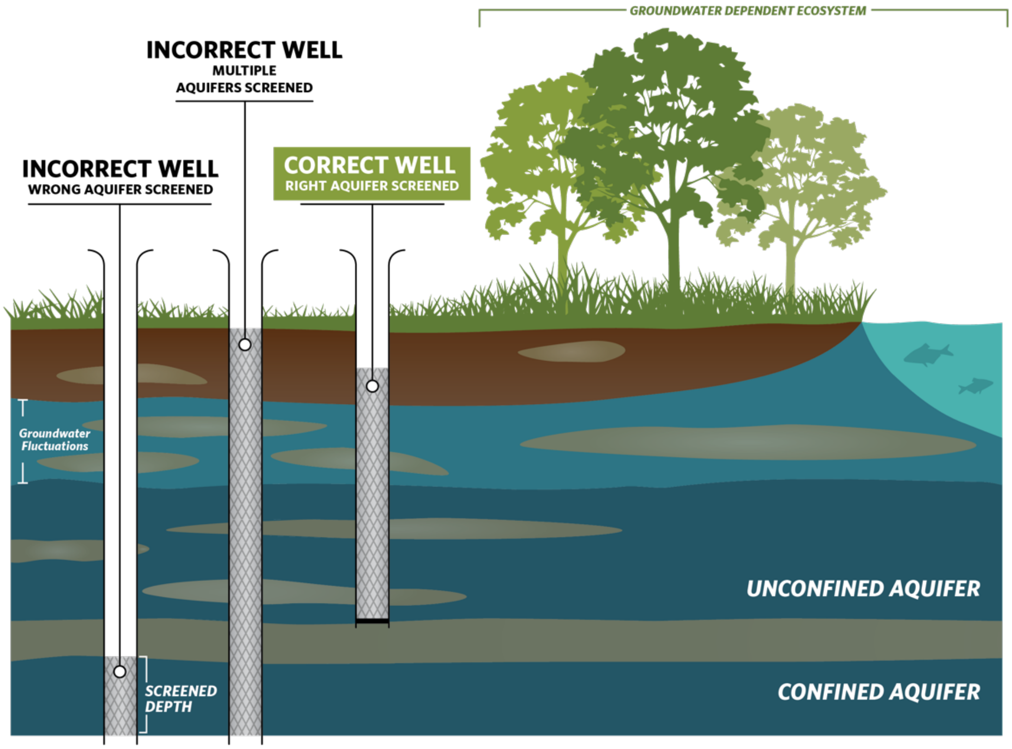

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

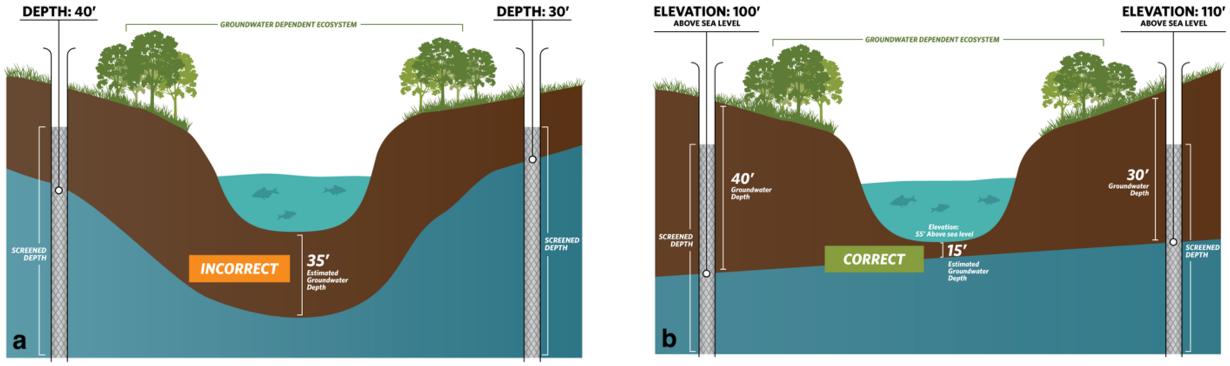

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

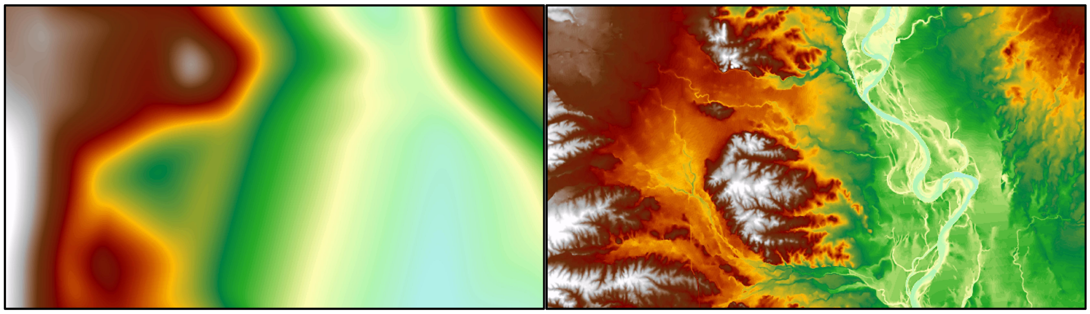

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

August 10, 2021

South American Subbasin Groundwater Sustainability Agencies

Submitted via email: jwoodling@geiconsultants.com; SASbGSP_Comments@kennedyjenks.com

Re: Public Comment Letter for the South American Subbasin Draft GSP

Dear John Woodling,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the South American Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the South American Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the subbasin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the South American Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. The GSP provides maps of DACs by blocks, places, and tracts on p. 69-71 of the Communication and Engagement Plan (Appendix 1-D). Additionally, the GSP provides a density map of domestic wells in the subbasin. The GSP does not, however, provide a map of tribal lands in the subbasin. Additionally, the Plan fails to identify the population dependent on groundwater as their source of drinking water in the subbasin. These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, to support the development of water budgets using the best available information, and to support the development of sustainable management criteria, and projects and management actions that are protective of these users.

RECOMMENDATIONS
● Provide a map of tribal lands in the subbasin. The GSP states (p. 2-10): “The only tribal land that falls within the SASb is located south of Elk Grove near the intersection of Kammerer Road and Hwy 99.” However no map, acreage, or population is provided. ● Include a map showing domestic well locations and average well depth across the subbasin. ● Provide the population of each identified DAC and include details on the population dependent on groundwater for their domestic water use.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **incomplete**. We commend the GSAs for the thorough, comprehensive evaluation of ISWs in the subbasin presented in Appendix 3-C of the GSP. The GSP uses an integrated surface and groundwater numerical flow model called CoSANA. Groundwater data for the model comes from historic and present day groundwater monitoring which adequately represents groundwater levels near the main surface water features. The groundwater data is from fall and spring over the period 2005 to 2018. The groundwater levels were interpolated, then compared to the nodes along the thalweg of the streams to identify where they intersected. Figure 2.3-46 of the GSP presents the interconnected and disconnected stream nodes, including areas with data gaps. The following recommendation would strengthen the clarity and completeness of the ISW evaluation.

RECOMMENDATIONS
• While the GSP clearly identifies data gaps and their locations, we recommend that the GSP considers any segments with data gaps as *potential* ISWs and clearly marks them as such on maps provided in the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to the lack of a complete inventory, map, or description of fauna (e.g., birds, fish, amphibians) and flora (e.g., plants) species or habitat types in the subbasin's GDEs.

Despite failing to identify fauna and flora, we commend the GSAs for their comprehensive evaluation of GDEs in the subbasin, as presented in the GDE Technical Memorandum (Appendix 3-B). By using groundwater data from spring and fall over the period 2005 to 2019, the GSP uses multiple water year types and seasonal groundwater level data to characterize groundwater conditions in the GDEs. The GSP provides depth-to-groundwater contour maps, using groundwater elevations that are subtracted from the DEM to estimate depth-to-groundwater contours. The GSP mapped GDEs and potential GDEs using multiple sources, including the NC Dataset, South Sacramento Habitat Conservation Plan, CDFW Vegetation, National Wetlands Inventory, and California Aquatic Resource Inventory. The following recommendations would further improve the analysis.

RECOMMENDATIONS
• The GSP states that a complete list of special status species is presented in Appendix E of the GSP, but this was not included in the public review draft. We recommend that the GSP includes a clear description of the fauna (e.g., birds, fish, amphibians) and flora (e.g., plants) that are dependent on GDEs within the GDE section of the GSP (see Attachment C of this letter for a list of freshwater species located in the South American subbasin). Also note any threatened or endangered species. • Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (Quercus lobata). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30 feet threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater.

Native Vegetation
Native vegetation is a water use sector that is required[1,2] to be included in the water budget. The integration of this ecosystem into the water budget is **sufficient**. We commend the GSA for including the groundwater demands of native vegetation in the historical, current and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development
Stakeholder engagement during GSP development is **incomplete**. SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the Stakeholder Communication and Engagement Plan (Appendix 1-D). The Stakeholder Communication and Engagement Plan should be improved by including more description of outreach to DACs, tribes, and environmental stakeholders during the GSP *implementation* phase, in addition to the GSP development phase.

RECOMMENDATIONS

- Describe efforts to engage with stakeholders during the GSP *implementation* phase in the Stakeholder Communication and Engagement Plan. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.
- Describe efforts to consult and engage with tribes within the subbasin. Refer to the DWR guidance entitled *Engagement with Tribal Governments* for specifics on how to consult with tribes.[4]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

[1] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]
[2] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]
[3] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]
[4] DWR Guidance Document for Engagement with Tribal Governments https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the subbasin are required when defining undesirable results[5] and establishing minimum thresholds[6,7].

Disadvantaged Communities and Drinking Water Users

According to the GSP, constituents of concern (COCs) in the subbasin are arsenic, nitrate, iron, manganese, and total dissolved solids (TDS). The GSP states that analyses of COCs are provided in Appendix 2-C, which is not yet available for review. Without this appendix, it is difficult to understand water quality trends in the subbasin. SMCs were developed for two of the COCs in the subbasin, nitrate and specific conductivity, however they were not developed for the other COCs.

We commend the GSAs for including a Shallow Well Protection Technical Memorandum (Appendix 3-A), which describes the impacts of lowering of groundwater levels and degraded water quality to domestic well owners. The GSP, however, does not describe the impacts of these groundwater conditions on DACs or tribes.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and tribes when defining undesirable results for chronic lowering of groundwater levels.
- Evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs and tribes.

Degraded Water Quality

- Describe direct and indirect impacts on DACs and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider domestic water users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[8]
- Evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs and tribes.
- Section 2.3.4 (Groundwater quality) discusses TDS, however Section 3.3.3 (Maximum threshold for degraded groundwater quality) discusses specific conductivity. Choose one measurement to describe salinity and use it consistently throughout the GSP.

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[5] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[6] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[7] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[8] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

- The plan only sets minimum thresholds and measurable objectives for nitrates and specific conductivity. The GSP should set SMC for the additional COCs in the subbasin (arsenic, iron, and manganese) and ensure they align with drinking water standards.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

We are concerned that the use of 2015 groundwater elevations as minimum thresholds for the chronic lowering of groundwater level SMC and as a proxy for the depletion of interconnected surface water SMC will not avoid undesirable results to environmental beneficial users. The true impacts to ecosystems under this scenario are not discussed in the GSP. If minimum thresholds are set to historic low groundwater levels and the subbasin is allowed to operate just above or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring in 2015, at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse. While ecosystems may have been only water stressed in 2015, they can be inadvertently destroyed if groundwater conditions are maintained just above those 2015 levels in the long-term, since the subbasin would be permitted to sustain extreme dry conditions over multiple seasons and years.

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels and depletions of interconnected surface waters, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by groundwater conditions in the subbasin. Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[9] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[10] can be determined.

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[11] require integration of climate

[9] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[10] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[11] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. To incorporate climate change, the GSP uses evapotranspiration, precipitation and streamflow data from a 50-year period (2020 to 2069) from the American River Basin Study. However, the methods through which it incorporates climate change are not well described, including which types of climate scenario and global climate model were used.

The GSP did not consider the 2070 extremely wet and extremely dry climate scenarios in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

The GSP included climate change into key inputs (precipitation, evapotranspiration, and surface water flow) of the projected water budget. However, the GSP does not calculate a sustainable yield based on the projected water budget with climate change incorporated (the GSP states that this section is under development). If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, and sustainable yield is not calculated, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems and domestic well owners.

RECOMMENDATIONS

- Provide more information regarding the selection of the American River Basin Study and the methods through which climate change is incorporated, since this is a different method than the use of climate change factors suggested by DWR.
- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**. Without adequate monitoring and identification of data gaps in the shallow aquifer, beneficial users of groundwater including GDEs, ISWs, DACs, tribal members, and domestic well users will remain unprotected by the GSP. The Plan therefore fails to meet SGMA's requirements for the monitoring network[12]. The GSP takes initial steps towards developing the monitoring network. However, we

[12] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

recommend the following steps to ensure that the monitoring network is protective of all beneficial users of groundwater.

RECOMMENDATIONS

- Provide maps that overlay monitoring well locations with the locations of DACs, domestic wells, and tribal areas to clearly identify potentially impacted areas. Ensure that existing and proposed representative monitoring sites adequately cover DAC, domestic well, and tribal portions of the subbasin.
- Provide specific steps to fill data gaps relating to representative monitoring sites that lack historical data or well screen information for wells on private lands.
- Determine what ecological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin. The GSP (Appendix 3-B) describes GDE analyses using NDVI. Describe more fully if NDVI will be used to assess impacts to GDEs during the GSP implementation phase.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions in the GSP is **insufficient**, due to failing to completely identify benefits or impacts of identified projects and management actions to key beneficial users.

The GSP states that the calculation of sustainable yield is still under development. However, we commend the GSAs for recognizing that groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for all beneficial users. The GSP states on p. 4-1 that "[t]o achieve the sustainability goals for the South American Subbasin (SASb) by 2042, and to avoid undesirable results over the remainder of a 50-year planning horizon, as required by SGMA regulations, multiple projects and management actions (PMAs) have been identified and considered by the five SASb Groundwater Sustainability Agencies (GSAs) in this Groundwater Sustainability Plan (GSP)."

We also commend the GSAs for the development of a shallow/vulnerable well protection program designed to provide assistance to users of shallow wells in the subbasin that are impacted by declines in groundwater levels in the vicinity of their wells, as described in Appendix 3-A. The following recommendations can further improve the projects and management actions section of the GSP.

RECOMMENDATIONS

- GDEs and ISWs, recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[13]

- For DACs, include a discussion of whether potential impacts to water quality from projects and management actions could occur. For example, groundwater recharge projects can have potential negative impacts to water quality which could cause undesirable results to drinking water beneficial users. Ensure that appropriate monitoring and mitigation aspects are included in the project development plans for recharge projects. Refer to Appendix B for drinking water well impact mitigation guidance.

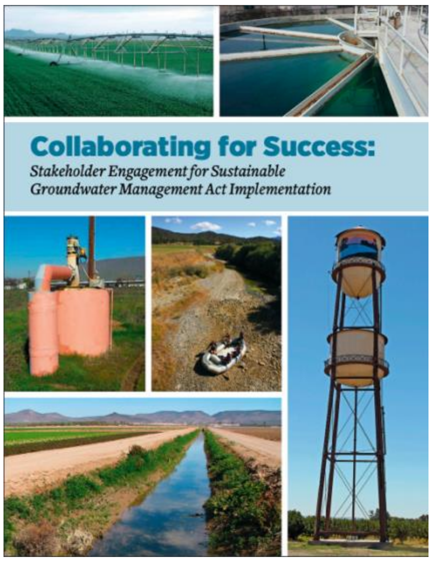
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[13] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

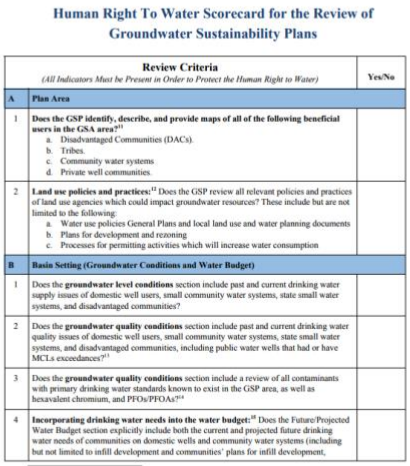
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

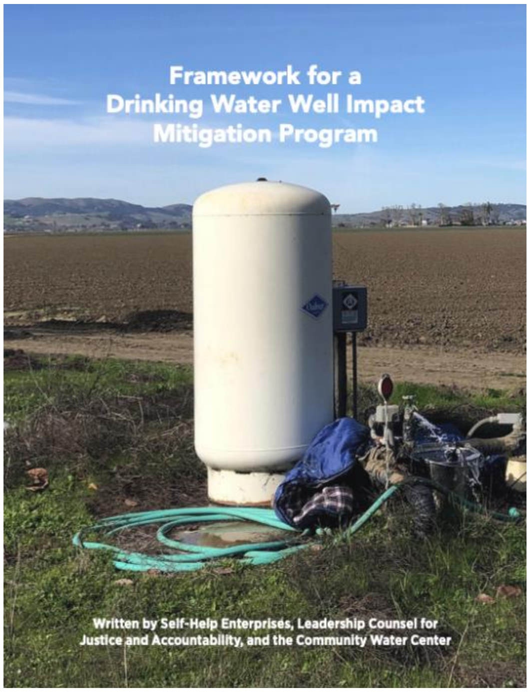


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*		Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

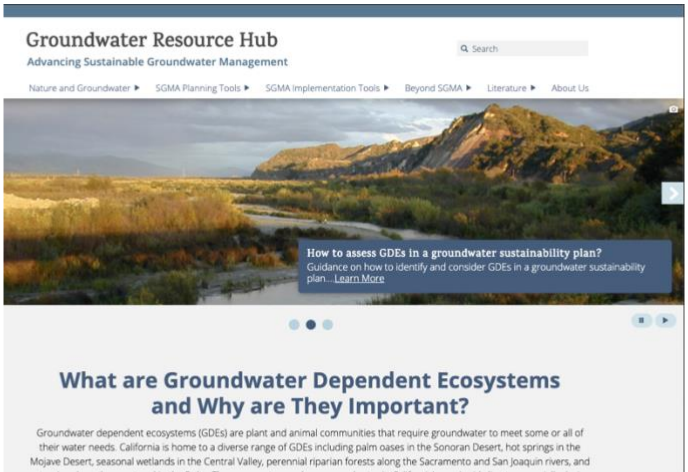
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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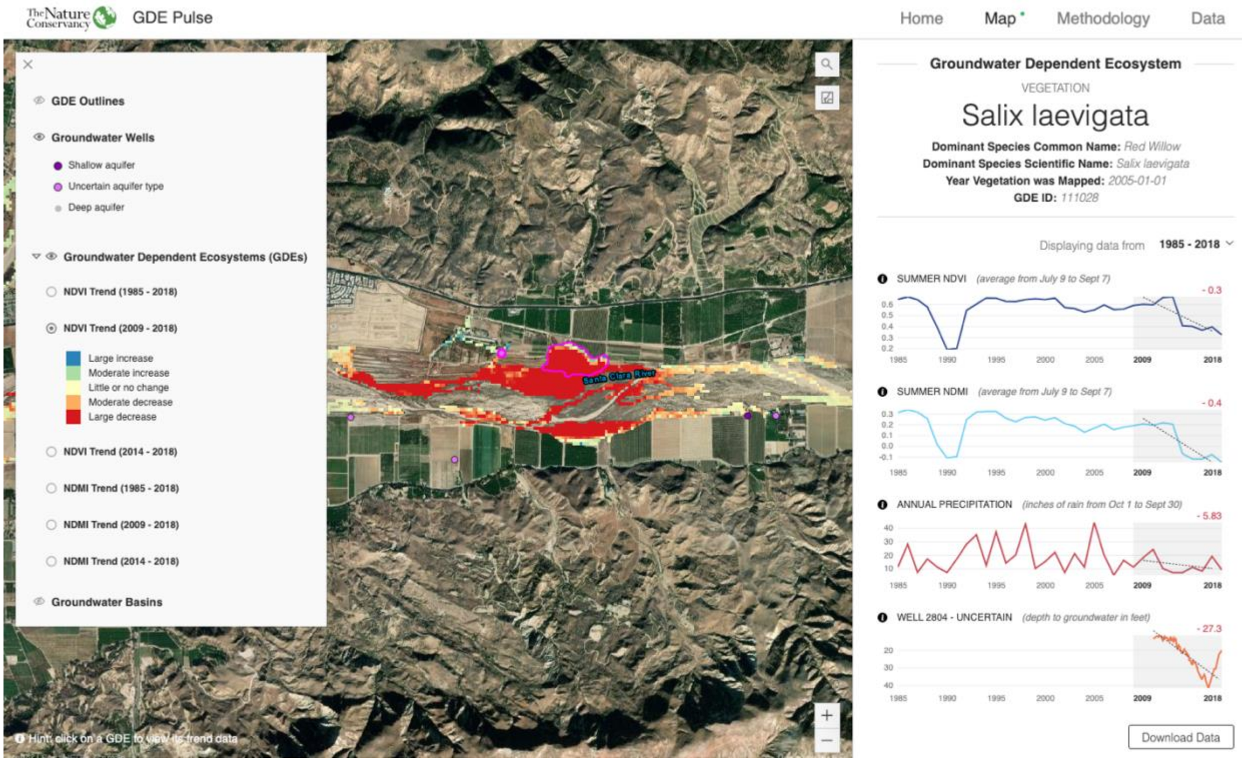
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

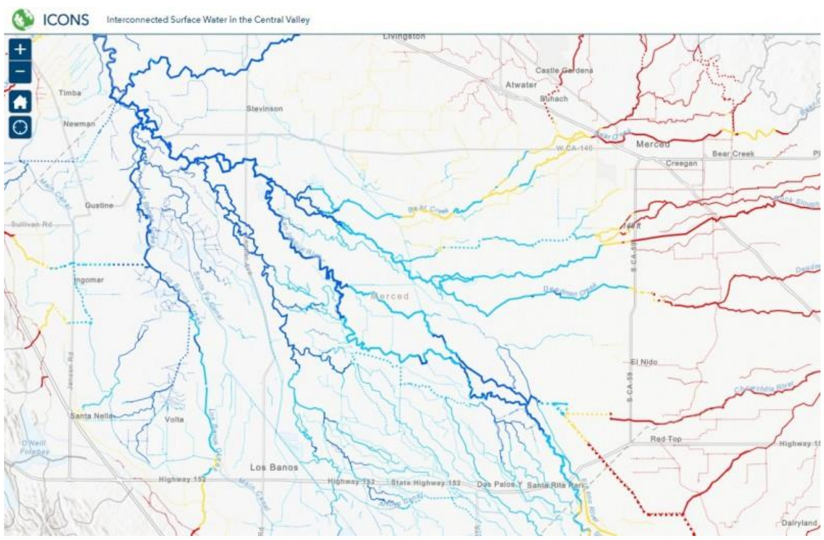
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the South American Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the South American Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Candidate - Threatened	Endangered	
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			

Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Branchinecta mesovallensis	Midvalley Fairy Shrimp		Special	
Dumontia oregonensis	A Water Flea		Special	
Hyalella spp.	Hyalella spp.			
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
FISH				
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013

Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endangered	Endangered	Vulnerable - Moyle 2013
Pogonichthys macrolepidotus	Sacramento splittail		Special Concern	Vulnerable - Moyle 2013
Spirinchus thaleichthys	Longfin smelt	Candidate	Threatened	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Pseudacris regilla	Northern Pacific Chorus Frog			
Pseudacris sierra	Sierran Treefrog			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis fitchi	Valley Gartersnake			Not on any status lists
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Aeshnidae fam.	Aeshnidae fam.			
Anax junius	Common Green Darner			
Apedilum spp.	Apedilum spp.			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Caenis spp.	Caenis spp.			
Callibaetis spp.	Callibaetis spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Cladopelma spp.	Cladopelma spp.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			

Corduliidae fam.	Corduliidae fam.			
Corixidae fam.	Corixidae fam.			
Cricotopus bicinctus				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Cryptotendipes spp.	Cryptotendipes spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Dytiscidae fam.	Dytiscidae fam.			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Enallagma praevarum	Arroyo Bluet			
Ephydridae fam.	Ephydridae fam.			
Erythemis collocata	Western Pondhawk			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Gomphus kurilis	Pacific Clubtail			
Hydraena spp.	Hydraena spp.			
Hydrochara rickseckeri	Ricksecker's Water Scavenger Beetle		Special	
Hydrophilidae fam.	Hydrophilidae fam.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Ischnura spp.	Ischnura spp.			
Lauterborniella spp.	Lauterborniella spp.			
Lestes stultus	Black Spreadwing			
Libellula forensis	Eight-spotted Skimmer			
Libellula luctuosa	Widow Skimmer			
Libellula pulchella	Twelve-spotted Skimmer			
Libellula spp.	Libellula spp.			
Libellulidae fam.	Libellulidae fam.			
Limnophyes spp.	Limnophyes spp.			
Liodessus spp.	Liodessus spp.			
Mideopsis spp.	Mideopsis spp.			
Nanocladius spp.	Nanocladius spp.			
Ochthebius spp.	Ochthebius spp.			
Ophiogomphus occidentis	Sinuous Snaketail			
Oxyethira spp.	Oxyethira spp.			
Pachydiplax longipennis	Blue Dasher			
Pantala flavescens	Wandering Glider			
Pantala hymenaea	Spot-winged Glider			

Pantala spp.	Pantala spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Peltodytes spp.	Peltodytes spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Plathemis lydia	Common Whitetail			
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Psectrocladius spp.	Psectrocladius spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Psychodidae fam.	Psychodidae fam.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Stylurus olivaceus	Olive Clubtail			
Sympetrum corruptum	Variegated Meadowhawk			
Tanypus spp.	Tanypus spp.			
Tanytarsus spp.	Tanytarsus spp.			
Telebasis salva	Desert Firetail			
Tramea lacerata	Black Saddlebags			
Trichocorixa spp.	Trichocorixa spp.			
Zoniagrion exclamationis	Exclamation Damsel			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus spp.	Gyraulus spp.			
Helisoma spp.	Helisoma spp.			
Hydrobiidae fam.	Hydrobiidae fam.			
Lanx patelloides	Kneecap Lanx		Special	E
Lymnaea spp.	Lymnaea spp.			
Margaritifera falcata	Western Pearlshell		Special	
Menetus spp.	Menetus spp.			
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Planorbidae fam.	Planorbidae fam.			
Sphaeriidae fam.	Sphaeriidae fam.			

Vorticifex effusa effusa	Artemesian Rams-horn			V
PLANTS				
Alisma triviale	Northern Water-plantain			
Alnus rhombifolia	White Alder			
Alopecurus carolinianus	Tufted Foxtail			
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla filiculoides	NA			
Bacopa rotundifolia	NA			
Beckmannia syzigachne	American Sloughgrass			
Berula erecta	Wild Parsnip			
Boehmeria cylindrica	NA			Not on any status lists
Brodiaea nana				Not on any status lists
Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche heterophylla heterophylla	Northern Water-starwort			
Callitriche marginata	Winged Water-starwort			
Carex comosa	Bristly Sedge		Special	CRPR - 2B.1
Carex densa	Dense Sedge			
Carex feta	Green-sheath Sedge			
Carex neurophora	Alpine-nerved Sedge			
Carex obnupta	Slough Sedge			
Carex scoparia scoparia	Broom Sedge		Special	CRPR - 2B.2
Carex stipata stipata	Stalk-grain Sedge			
Cephalanthus occidentalis	Common Buttonbush			
Ceratophyllum demersum	Common Hornwort			
Chamaecyparis lawsoniana				Not on any status lists
Cicendia quadrangularis	Oregon Microcala			
Cicuta maculata bolanderi	Bolander's Water-hemlock		Special	CRPR - 2B.1
Comarum palustre	Marsh Cinquefoil			
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Crypsis vaginiflora	NA			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus involucratus	NA			
Cyperus squarrosus	Awned Cyperus			
Damasonium californicum				Not on any status lists
Downingia bicornuta	NA			

Downingia cuspidata	Toothed Calicoflower			
Downingia ornatissima	NA			
Downingia pulchella	Flat-face Downingia			
Downingia pusilla	Dwarf Downingia		Special	CRPR - 2B.2
Echinodorus berteroi	Upright Burhead			
Elatine brachysperma	Shortseed Waterwort			
Elatine californica	California Waterwort			
Elatine rubella	Southwestern Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis acicularis occidentalis				Not on any status lists
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Eleocharis obtusa	Blunt Spikerush			
Eleocharis palustris	Creeping Spikerush			
Eleocharis quadrangulata	NA			
Elodea nuttallii	Nuttall's Waterweed			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eragrostis hypnoides	Teal Lovegrass			
Eryngium aristulatum aristulatum	California Eryngo			
Eryngium articulatum	Jointed Coyote-thistle			
Eryngium castrense	Great Valley Eryngo			
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Galium trifidum	Small Bedstraw			
Gratiola ebracteata	Bractless Hedge-hyssop			
Gratiola heterosepala	Boggs Lake Hedge-hyssop		Endangered	CRPR - 1B.2
Gratiola neglecta	Clammy Hedge-hyssop			
Helenium puberulum	Rosilla			
Hibiscus lasiocarpos occidentalis			Special	CRPR - 1B.2
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Hypericum anagalloides	Tinker's-penny			
Isoetes howellii	NA			
Isoetes nuttallii	NA			
Isoetes orcuttii	NA			
Isolepis cernua	Low Bulrush			
Juncus acuminatus	Sharp-fruit Rush			

Juncus articulatus articulatus				Not on any status lists
Juncus diffusissimus	NA			
Juncus effusus effusus	NA			
Juncus effusus pacificus				
Juncus uncialis	Inch-high Rush			
Juncus xiphioides	Iris-leaf Rush			
Lasthenia fremontii	Fremont's Goldfields			
Lathyrus jepsonii	NA		Special	CRPR - 1B.2
Leersia oryzoides	Rice Cutgrass			
Legenere limosa	False Venus'-looking-glass		Special	CRPR - 1B.1
Lemna minor	Lesser Duckweed			
Lilaeopsis masonii	Mason's Lilaeopsis		Special	CRPR - 1B.1
Limnanthes alba alba	White Meadowfoam			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limnanthes douglasii rosea	Douglas' Meadowfoam			
Limnobium spongia	NA			Not on any status lists
Limosella acaulis	Southern Mudwort			
Limosella aquatica	Northern Mudwort			
Limosella australis	NA		Special	CRPR - 2B.1
Lobelia cardinalis cardinalis	NA			
Ludwigia peploides montevidensis	NA			Not on any status lists
Ludwigia peploides peploides	NA			Not on any status lists
Lycopus americanus	American Bugleweed			
Lythrum portula	NA			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Mimulus pilosus				Not on any status lists
Mimulus tricolor	Tricolor Monkeyflower			
Montia fontana fontana	Fountain Miner's-lettuce			
Myosurus minimus	NA			
Myriophyllum sibiricum	Common Water-milfoil			
Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Oenanthe sarmentosa	Water-parsley			
Orcuttia tenuis	Slender Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Orcuttia viscida	Sacramento Orcutt Grass	Endangered	Endangered	CRPR - 1B.1

Panicum acuminatum acuminatum				Not on any status lists
Panicum dichotomiflorum	NA			
Paspalum distichum	Joint Paspalum			
Perideridia kelloggii	Kellogg's Yampah			
Persicaria amphibia				Not on any status lists
Persicaria hydropiper	NA			Not on any status lists
Persicaria hydropiperoides				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phacelia distans	NA			
Phalaris arundinacea	Reed Canarygrass			
Phragmites australis australis	Common Reed			
Phyla lanceolata	Fog-fruit			
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Pinguicula macroceras	NA		Special	CRPR - 2B.2
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plagiobothrys undulatus	NA			Not on any status lists
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pleuropogon californicus californicus				Not on any status lists
Pogogyne douglasii	NA			
Pogogyne zizyphoroides				Not on any status lists
Polygonum marinense	Marin Knotweed		Special	CRPR - 3.1
Potamogeton diversifolius	Water-thread Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus brevissimus multiflorus	Delta Woolly Marbles		Special	CRPR - 4.2
Psilocarphus oregonus	Oregon Woolly-heads			
Psilocarphus tenellus	NA			
Ranunculus bonariensis	NA			
Ranunculus pusillus pusillus	Pursh's Buttercup			

Ranunculus sceleratus	NA			
Rorippa curvipes	Rocky Mountain Yellowcress			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rorippa palustris palustris	Bog Yellowcress			
Rumex conglomeratus	NA			
Rumex occidentalis				Not on any status lists
Rumex salicifolius salicifolius	Willow Dock			
Rumex stenophyllus	NA			
Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Sagittaria montevidensis calycina				Not on any status lists
Sagittaria sanfordii	Sanford's Arrowhead		Special	CRPR - 1B.2
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Samolus parviflorus	NA			Not on any status lists
Schoenoplectus acutus acutus	NA			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus californicus	California Bulrush			
Scutellaria galericulata	Hooded Skullcap		Special	CRPR - 2B.2
Sequoia sempervirens				
Sidalcea calycosa calycosa	Annual Checker-mallow			
Sidalcea hirsuta	Hairy Checker-mallow			
Sparganium eurycarpum eurycarpum				
Stachys ajugoides	Bugle Hedge-nettle			
Stachys albens	White-stem Hedge-nettle			
Symphyotrichum lentum	Suisun Marsh Aster		Special	CRPR - 1B.2
Triglochin scilloides	NA			Not on any status lists
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica catenata	NA			Not on any status lists
Veronica peregrina	NA			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

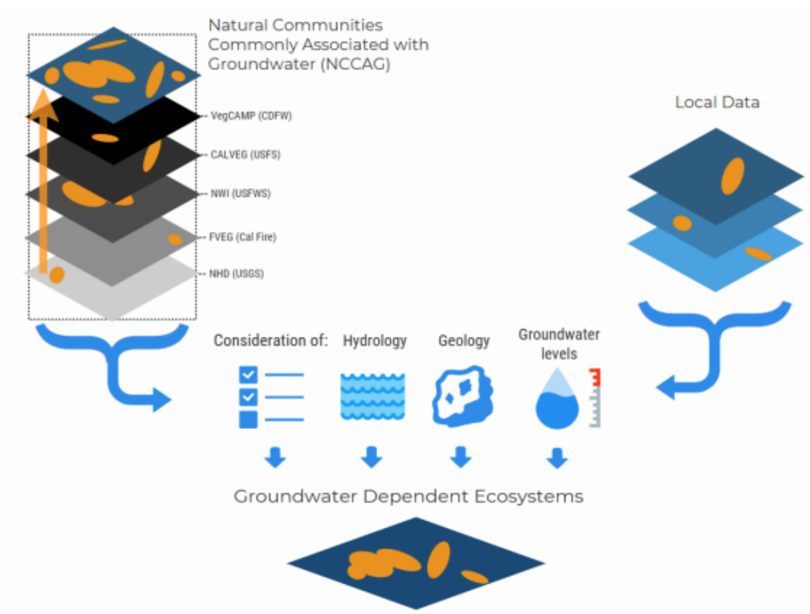


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

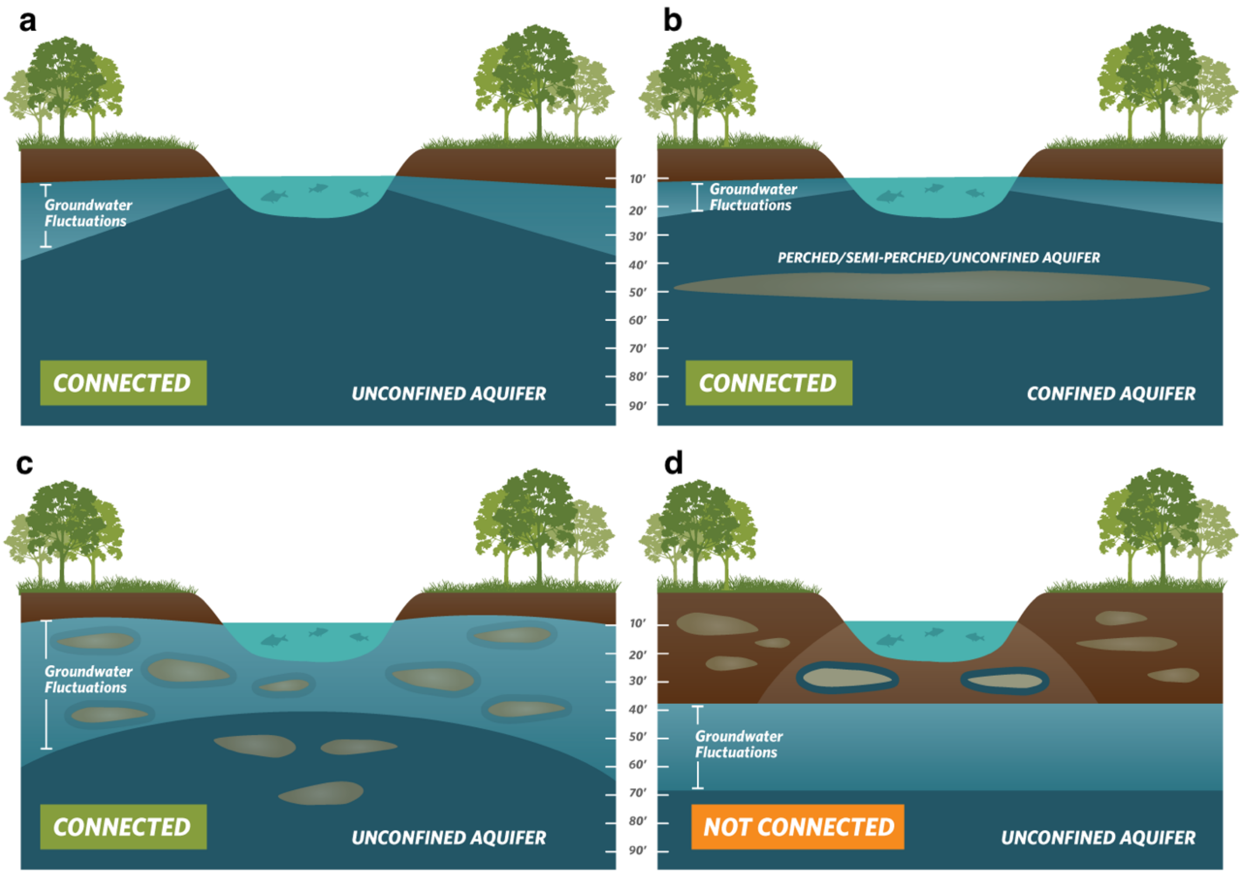

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

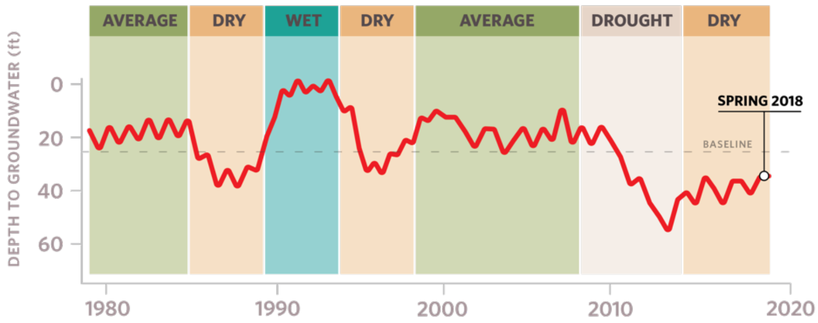

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

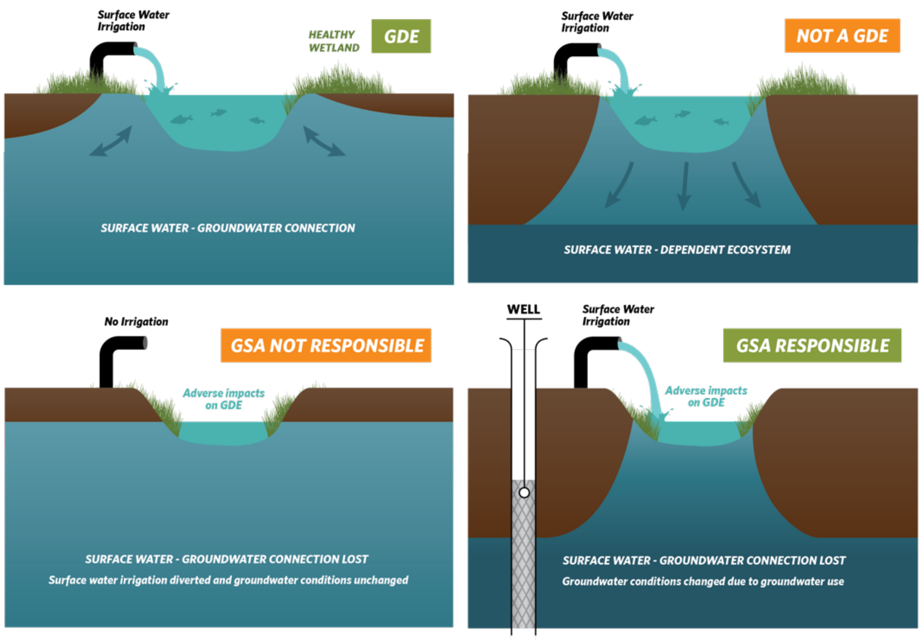

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

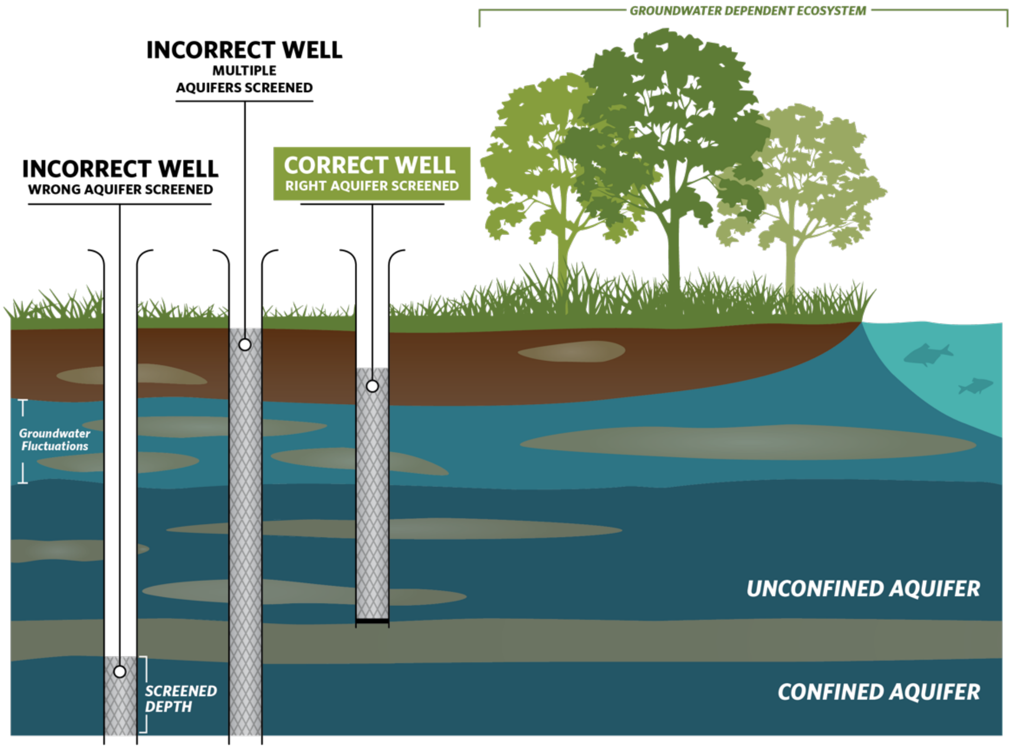

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

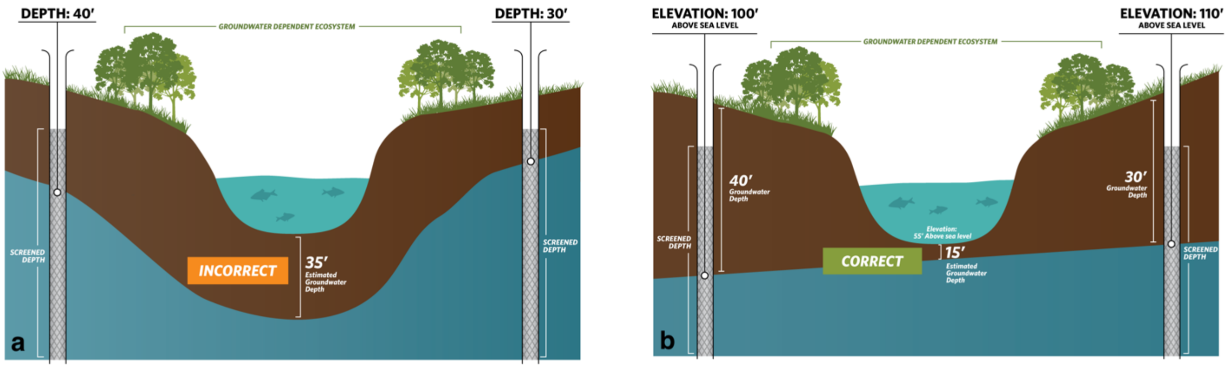

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

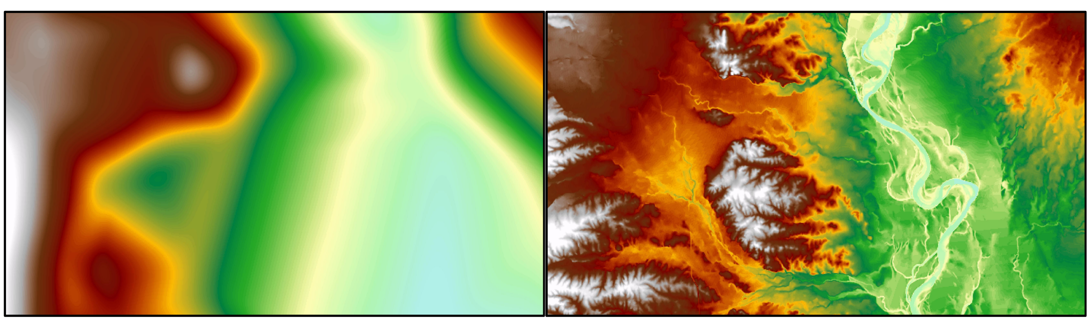

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

November 12, 2021

Sutter Subbasin Groundwater Management Coordination Committee

Submitted via email: info@suttersubbasin.org

Re: Public Comment Letter for Sutter Subbasin Draft GSP

Dear Guadalupe Rivera,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Sutter Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Sutter Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
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Melissa M. Rohde
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Amy Merrill, Ph.D.
Acting Director, California Program
American Rivers

Kristan Culbert
Associate Director, California Central Valley River Conservation
American Rivers

Attachment A

Specific Comments on the Sutter Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes
The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. The GSP identifies and maps the locations of DACs and describes each DAC population within the subbasin. However, we note the following deficiencies with the identification of these key beneficial users:

- The GSP identifies tribal communities that may have cultural and traditional ties within the subbasin. However, the plan fails to map the locations of tribal lands or tribal interests in the subbasin.
- The GSP provides a map of domestic well density in Figure 2-9, but fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin. This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the basin.
- While the GSP identifies the population dependent on groundwater as their source of drinking water in the subbasin, specifics are not provided on how much each DAC community relies on a particular water supply (e.g., what percentage is supplied by groundwater).
- The GSP references CalEnviroScreen 3.0, but is not updated with the most recent CalEnviroScreen results from 4.0.

These missing elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

RECOMMENDATIONS
• Provide a map of tribal lands and describe tribal interests in the subbasin. • Include a map showing domestic well locations and average well depth across the subbasin. • Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). • Utilize the updated version 4.0 of CalEnviroScreen.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **incomplete**. Streamflow depletion in the Sutter Subbasin was evaluated using the C2VSimFG-Sutter model, an integrated hydrologic flow model for the subbasin. The model is described in Appendix 5-G (C2VSimFG-Sutter Model Report) and simulates the period from 1996 to 2015. Appendix 5-G describes the data used in the model, including the location and screening depths of groundwater wells and stream gauge data in the subbasin.

The GSP confirms the results of the ISW analysis with data from TNC's Interconnected Surface Water in the Central Valley (ICONS) website, as presented on Figure 5-92 of the GSP.[2]

Stream nodes from the model were characterized as having gaining conditions, losing conditions, or mixed conditions (Figure 5-91). The GSP states: *"The C2VSimFG-Sutter model does not contain stream nodes in the Sutter Buttes foothills, and therefore the interaction between those streams and the underlying water table were not evaluated."* We recommend that these stream reaches are retained as potential ISWs in the GSP until further data is gathered.

RECOMMENDATIONS
• To confirm the results of the groundwater modeling analysis and support conclusions about the Sutter Buttes foothills stream reaches, overlay the stream reaches shown with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. • Describe data gaps for the ISW analysis in the ISW section, in addition to the discussion in Section 7.2.6.6.5 (Interconnected Surface Water Monitoring Network Data Gaps). While the GSP identifies data gaps and their locations in the text, we

[2]Available online at: https://icons.codefornature.org/

recommend that the GSP considers any segments with data gaps as potential ISWs and clearly marks them as such on maps provided in the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, we found that some mapped features in the NC dataset were improperly disregarded. NC dataset polygons were incorrectly removed in areas adjacent to irrigated fields or adjacent to rivers and streams. However, this removal criteria is flawed since GDEs can rely on multiple water sources – including shallow groundwater receiving inputs from surface water flow or irrigation return flow from nearby irrigated fields – simultaneously and at different temporal/spatial scales. NC dataset polygons adjacent to irrigated land or surface water supplies can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to these additional water sources.

The GSP identifies and maps GDEs in normal (2013), dry (2015), and wet (2017) years based on a 30-foot screening threshold; maps are presented in Figures 5-96, 5-97, and 5-98, respectively. However, no description or presentation of groundwater data (such as depth-to-groundwater contour maps) is provided. Furthermore, it is unclear which GDEs are retained as potential GDEs for the purposes of establishing monitoring and sustainable management criteria.

The GSP states (5-173): *"Oak trees are considered the deepest-rooted plant in the region with a root zone of roughly 25 to 30 feet."* If Valley Oaks exist in the subbasin, we recommend instead that an 80-foot depth-to-groundwater threshold be used when inferring whether Valley Oak polygons in the NC dataset are likely reliant on groundwater. This recommendation is based on a recent correction in TNC's rooting depth database,[3] after finding a typo in the max rooting depth units for Valley Oak. This resulted in a specific change in the max rooting depth of Valley Oak from 24 feet to 24 meters (80 feet). For all other phreatophytes, we continue to recommend that a 30-foot depth-to-groundwater threshold be used when inferring whether all other NC dataset polygons are likely reliant on groundwater.

RECOMMENDATIONS

- Re-evaluate the NC dataset polygons that are adjacent to irrigated fields or streams and rivers. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater

[3] TNC. 2021. Plant Rooting Depth Database. Available at: https://groundwaterresourcehub.org/sgma-tools/gde-rooting-depths-database-for-gdes/

elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as Valley Oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether Valley Oak polygons from the NC Dataset are connected to groundwater. It is important to emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and proximity to other water sources.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[4,5] The integration of these ecosystems into the water budget is **sufficient** because the GSP includes the groundwater demands of native vegetation and managed wetlands as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Outreach and Communication chapter of the GSP (Chapter 4).[6]

We note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement in general terms. Public outreach and engagement activities include quarterly public workshops, public meetings, updates at GSA board and city council meetings, updates to the project website, email notices, social media postings, press releases and mailings, utility bill notifications, supporting materials provided in English, Spanish, and Punjabi, and online surveys for stakeholder feedback and input. There are no details of outreach and engagement specifically targeted to DACs, drinking water users, tribes, and environmental stakeholders during the GSP development process.

[4] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]
[5] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]
[6] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- Aside from the continuation of engagement strategies used during the GSP development process, the GSP does not include a detailed plan for continual opportunities for engagement through the *implementation* phase of the GSP that is specifically directed to DACs, drinking water users, tribes, and environmental stakeholders.

RECOMMENDATIONS
• In the Outreach and Communication chapter, describe active and targeted outreach to engage DACs, drinking water users, tribes, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. • Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the subbasin within the GSP.[7]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[8,9,10]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP states (p. 6-11): *"The minimum threshold for chronic lowering of groundwater levels is established as the deepest of the following: The historic low for the available record at each representative monitoring site; or 2. 90% of the average groundwater elevation from the projected water budget (baseline condition over 60-year period using C2VSimFG-Sutter) at each representative monitoring site with an artificial increase in evapotranspiration (ET) of 50%; or 3. The average operating range (difference between measurable objective and minimum threshold) for all representative monitoring sites using the above criteria for the following aquifer zones (AZs), applied based on the available screen interval or well depth information for each representative monitoring site: a. Shallow AZ and AZ-1 = 8.0 feet b. AZ-2 and AZ-3 = 16.5 feet."*

The GSP states (6-17): *"The average operating range for the Shallow AZ and AZ-1 were combined with the goal of being protective of interconnected surface waters, GDEs, and*

[7] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[8] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[9] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[10] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

shallow domestic wells." The text continues (p. 6-17): *"A minimum operating range is applied where applicable in order to allow for a reasonable use of groundwater by all beneficial users in the Sutter Subbasin."* However, no analysis is presented that describes the impact of minimum thresholds on domestic well users. The GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users, and whether the undesirable results are consistent with the Human Right to Water policy.[11] In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs or tribes when defining undesirable results, nor does it describe how the groundwater levels minimum thresholds are consistent with Human Right to Water policy and will avoid significant and unreasonable impacts on these beneficial users.

For degraded water quality, SMC are established for total dissolved solids (TDS) and nitrate. The GSP states (p. 6-24): *"The minimum threshold for degraded water quality is established as the highest of: (1) the Upper SMCL for TDS (1,000 mg/L) and Primary MCL for nitrate as N (10 mg/L) or (2) current water quality conditions for TDS and nitrate as N based on data available from 2000 to the time of GSP development (Summer 2021) at the representative monitoring well or nearby well within the same aquifer zone, as described in Section 5.2.5 of the Basin Setting chapter, using maximum concentration detected of each constituent."* However, according to the state's anti-degradation policy,[12] high water quality should be protected and is only allowed to worsen if a finding is made that it is in the best interest of the people of the State of California. No analysis has been done and no such finding has been made.

Section 5.1.9 of the GSP (Water Quality) discusses water quality trends for several other constituents, including arsenic, boron, iron, manganese, and point-source contaminants. No SMC have been established for these additional constituents, however. SMC should be established for all COCs in the subbasin impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

The GSP only includes a very general discussion of impacts on drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs or tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on these beneficial users.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users, DACs, and tribes within the subbasin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be fully or partially de-watered at the minimum threshold.

[11] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3
[12] Anti-degradation Policy. Available at: https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality.[13] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[14]
- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.
- For TDS and nitrate, provide a summary table that presents the pre-2015 historical maximums, the objectives from the Basin Plan, the MCLs, and the resulting minimum thresholds. Ensure that the minimum thresholds do not exceed the objectives in the Basin Plan.
- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management.
- Set minimum thresholds that do not allow water quality to degrade to levels at or above the MCL trigger level.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

For chronic lowering of groundwater levels, minimum thresholds are established in the same manner as stated above under Disadvantaged Communities and Drinking Water Users (i.e., established as the deeper of three values). The result is that minimum thresholds allow groundwater levels to drop to, or below, historic lows in the subbasin. To describe effects on environmental beneficial uses and users, the GSP states (p. 6-22): *"Environmental users of groundwater typically rely on shallow groundwater (within 50 feet of ground surface or less) for recharge to interconnected streams and access by GDEs. If minimum thresholds for chronic lowering of groundwater levels are exceeded (even if an undesirable result is not observed), reduced groundwater recharge to streams and groundwater levels too deep for GDE species to access may be observed."* The true impacts to ecosystems under this scenario are not fully discussed in the GSP. By assuming that GDEs can be sustained on historic low groundwater levels (or lower) and the subbasin is allowed to operate at or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that is more adverse than what was occurring at the height of the 2012-2016 drought. While many California ecosystems are drought-adapted and therefore able to accommodate short-term water stress, prolonged drought conditions could cause adverse impacts, such as widespread tree mortality or loss of critical habitat for aquatic species, that are more severe than pre-2015 drought impacts.

For depletion of interconnected surface water, groundwater elevations are used as proxy for establishing SMC. As for chronic lowering of groundwater levels, minimum thresholds are again established in the same manner as stated above under Disadvantaged Communities and Drinking Water Users (i.e., established as the deeper of three values). To describe effects on

[13] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[14] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

environmental beneficial uses and users, the GSP states (p. 6-46): *"If an undesirable result for depletions of interconnected surface water is observed and presently gaining streams become losing streams, this reversal of stream interconnection would affect aquatic systems and potentially GDEs. Overall water supply utilized by environmental beneficial users of water would be reduced, thereby reducing suitable habitat through reduced stream depth, flow velocity, cover, and dissolved oxygen as well as increased temperature."* However, no analysis or discussion is presented to describe how the SMC will affect beneficial users, and more specifically GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin.[15] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[16]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[17] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,18]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

[15] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[16] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[17] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]
[18] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[19] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[20] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2070. The plan reports some calculations in the Appendix for an Extremely Dry scenario to stress the system but does not seem to report and compare such results outside the Appendix. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP integrates climate change into key inputs (e.g., changes in precipitation and evapotranspiration) of the projected water budget. However, imported water should also be adjusted for climate change and incorporated into the surface water flow inputs of the projected water budget. The sustainable yield is calculated based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of extreme climate scenarios and the omission of projected climate change effects on imported water inputs, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, tribes, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change into surface water flow inputs, including imported water, for the projected water budget.
- Incorporate climate change scenarios into projects and management actions.

[19] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]
[20] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Wells (RMWs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs and domestic wells in the subbasin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[21]

Figure 7-2 (Groundwater Level Monitoring Network Wells, Shallow AZ) shows insufficient representation of DACs and drinking water users for shallow groundwater elevation monitoring. Figure 7-7 (Groundwater Quality Monitoring Network Wells, Shallow AZ) shows insufficient representation of DACs and drinking water users for shallow water quality monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify monitored areas.
- Increase the number of RMWs in the shallow aquifer across the subbasin as needed to map ISWs and adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMWs.
- Ensure groundwater elevation and water quality RMWs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.
- Provide further details for the biological monitoring (described in the Projects and Management Actions section of the GSP) that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **sufficient** due to the plan's clear identification of the benefits and impacts of projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs and DACs.

We commend the GSAs for describing the environmental benefits of the on-farm groundwater recharge program in the Sutter Subbasin, as developed with support and guidelines from The Nature Conservancy (TNC). The program is based on the TNC's multi-benefit recharge program.

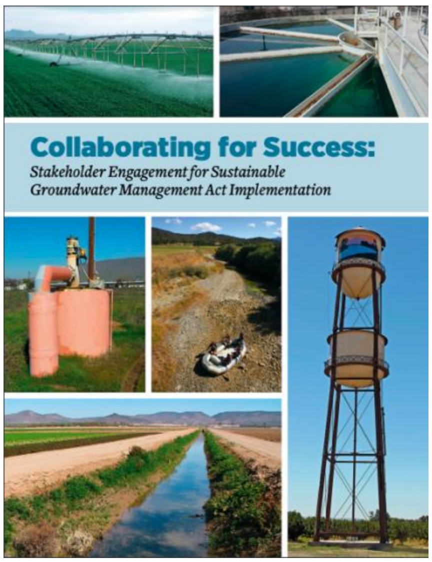
[21] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

Because the GSP fails to clearly analyze impacts to domestic wells and DACs due to chronic lowering of groundwater levels, we recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation.

RECOMMENDATIONS
● For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program. ● Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

Attachment B
SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

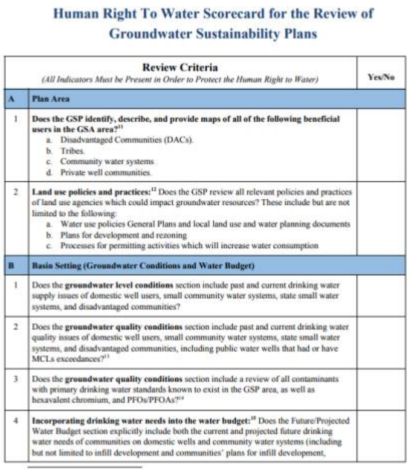
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

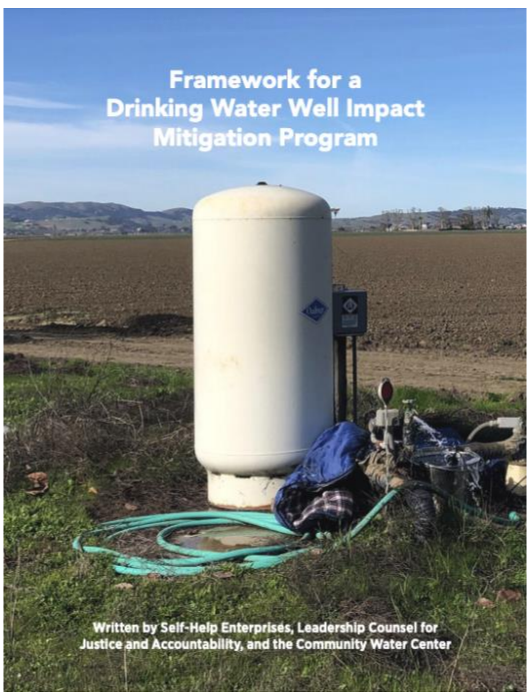


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

Review Criteria (All Indicators Must be Present in Order to Protect the Human Right to Water)		Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

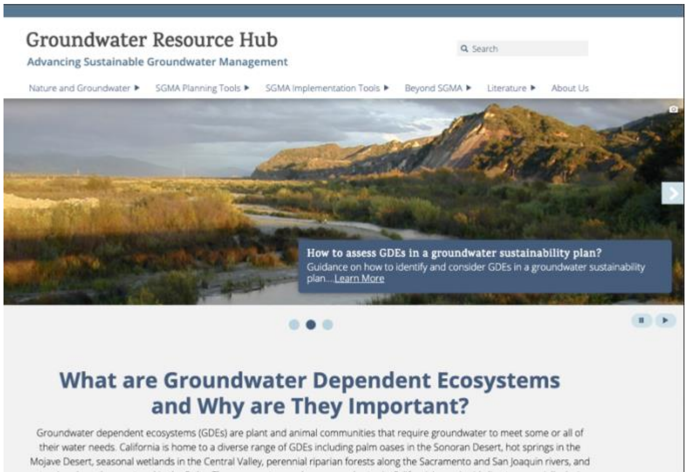
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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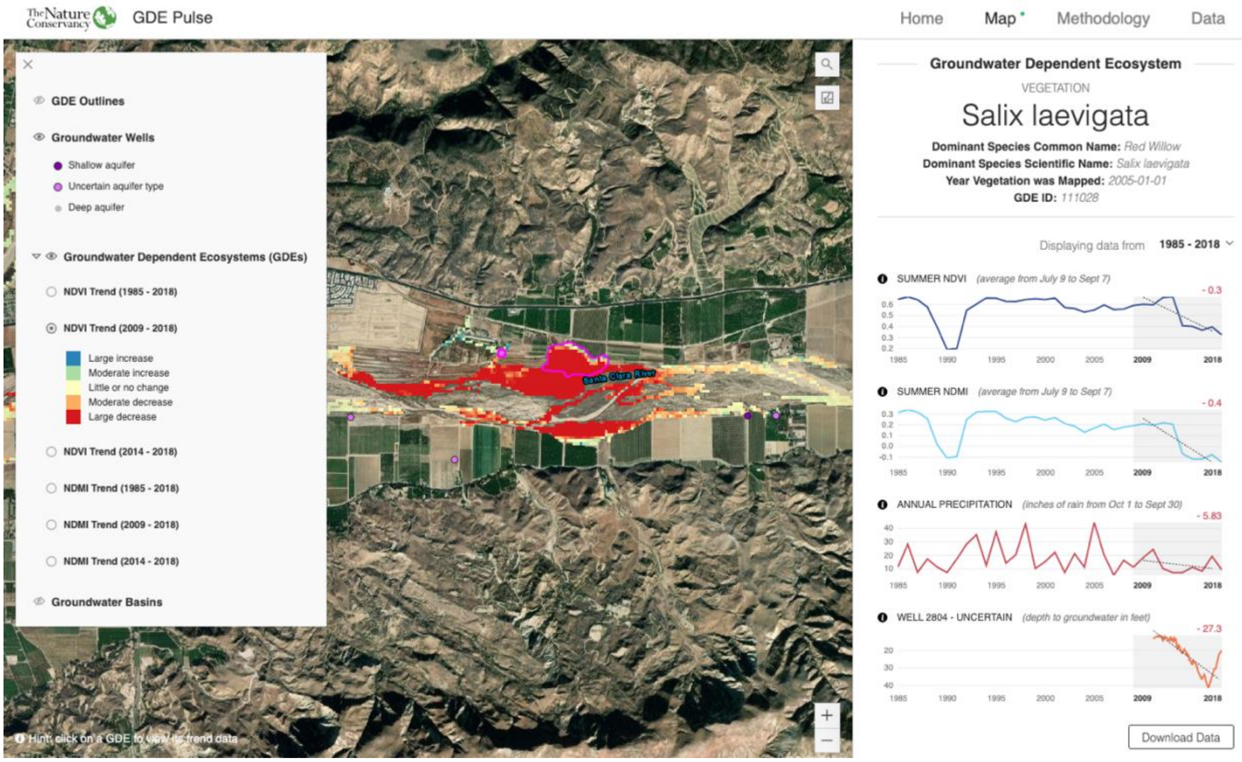
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

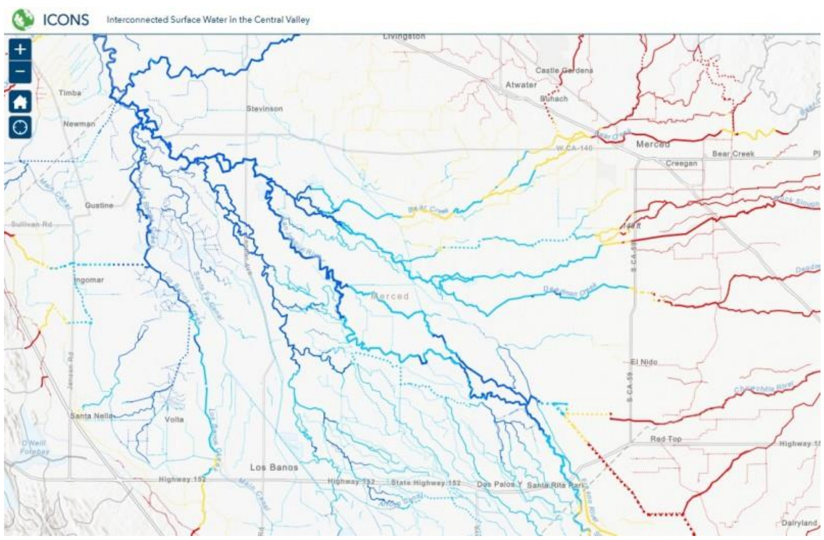
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Sutter Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Sutter Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Candidate - Threatened	Endangered	
Laterallus jamaicensis coturniculus	California Black Rail	Bird of Conservation Concern	Threatened	
Riparia riparia	Bank Swallow		Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Grus canadensis	Sandhill Crane			

Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority

Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
Cambaridae fam.	Cambaridae fam.			
Hyalella spp.	Hyalella spp.			
FISHES				
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Pogonichthys macrolepidotus	Sacramento splittail		Special Concern	Vulnerable - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endangered	Endangered	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate	Special Concern	ARSSC

		or Petition Process		
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
Pseudacris regilla	Northern Pacific Chorus Frog			
Thamnophis atratus atratus	Santa Cruz Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Aeshnidae fam.	Aeshnidae fam.			
Belostoma spp.	Belostoma spp.			
Caenis spp.	Caenis spp.			
Callibaetis spp.	Callibaetis spp.			
Centroptilum spp.	Centroptilum spp.			
Chironomidae fam.	Chironomidae fam.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corixidae fam.	Corixidae fam.			
Enallagma carunculatum	Tule Bluet			
Ephydridae fam.	Ephydridae fam.			
Hydrophilidae fam.	Hydrophilidae fam.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ischnura cervula	Pacific Forktail			
Ischnura spp.	Ischnura spp.			
Leptoceridae fam.	Leptoceridae fam.			
Libellula luctuosa	Widow Skimmer			
Libellula pulchella	Twelve-spotted Skimmer			
Libellula saturata	Flame Skimmer			
Liodessus spp.	Liodessus spp.			
Mideopsis spp.	Mideopsis spp.			
Oxyethira spp.	Oxyethira spp.			
Pachydiplax longipennis	Blue Dasher			

Rhionaeschna multicolor	Blue-eyed Darner			
Sperchon spp.	Sperchon spp.			
Trichocorixa spp.	Trichocorixa spp.			
Tricorythodes spp.	Tricorythodes spp.			
Veliidae fam.	Veliidae fam.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Ferrissia spp.	Ferrissia spp.			
Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus spp.	Gyraulus spp.			
Hydrobiidae fam.	Hydrobiidae fam.			
Lymnaeidae fam.	Lymnaeidae fam.			
Margaritifera falcata	Western Pearlshell		Special	
Physa spp.	Physa spp.			
PLANTS				
Hibiscus lasiocarpos occidentalis			Special	CRPR - 1B.2
Alopecurus carolinianus	Tufted Foxtail			
Ammannia robusta	Grand Redstem			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Bacopa rotundifolia	NA			

Bolboschoenus fluviatilis				Not on any status lists
Callitriche marginata	Winged Water-starwort			
Crassula aquatica	Water Pygmyweed			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus iria	NA			Not on any status lists
Downingia bicornuta	NA			
Downingia ornatissima	NA			
Echinodorus berteroi	Upright Burhead			
Eleocharis engelmannii engelmannii	Engelmann's Spikerush			Not on any status lists
Eleocharis macrostachya	Creeping Spikerush			
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium castrense	Great Valley Eryngo			
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Isoetes howellii	NA			
Lemna minuta	Least Duckweed			
Ludwigia peploides peploides	NA			Not on any status lists
Lythrum californicum	California Loosestrife			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus tricolor	Tricolor Monkeyflower			
Najas guadalupensis guadalupensis	Southern Naiad			
Navarretia cotulifolia	Cotula Navarretia			

Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Panicum dichotomiflorum	NA			
Paspalum distichum	Joint Paspalum			
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phacelia distans	NA			
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pogogyne douglasii	NA			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Sagittaria longiloba	Longbarb Arrowhead			
Sagittaria montevidensis calycina				Not on any status lists
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			

Salix lasiolepis lasiolepis	Arroyo Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Sinapis alba	NA			
Stachys stricta	Sonoma Hedge-nettle			
Typha latifolia	Broadleaf Cattail			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

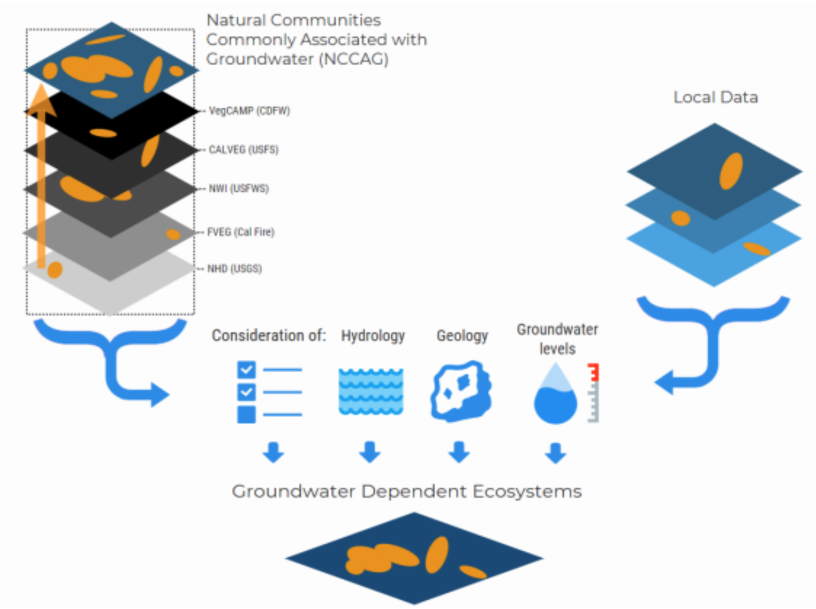


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

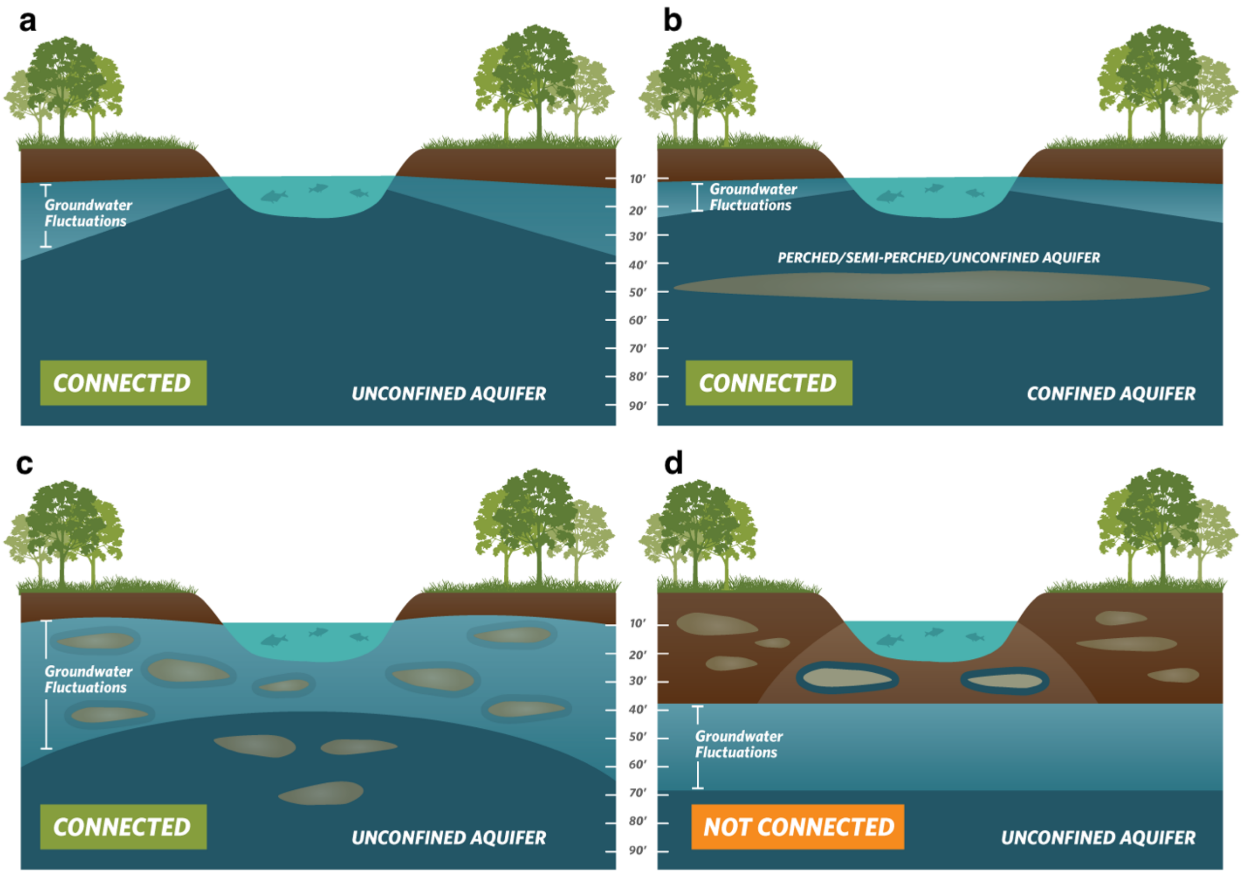

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

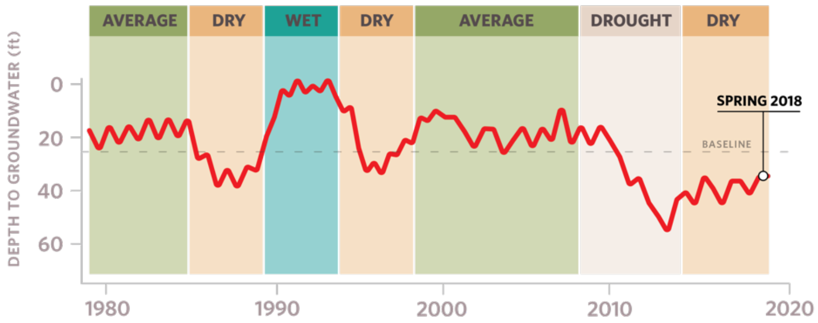

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

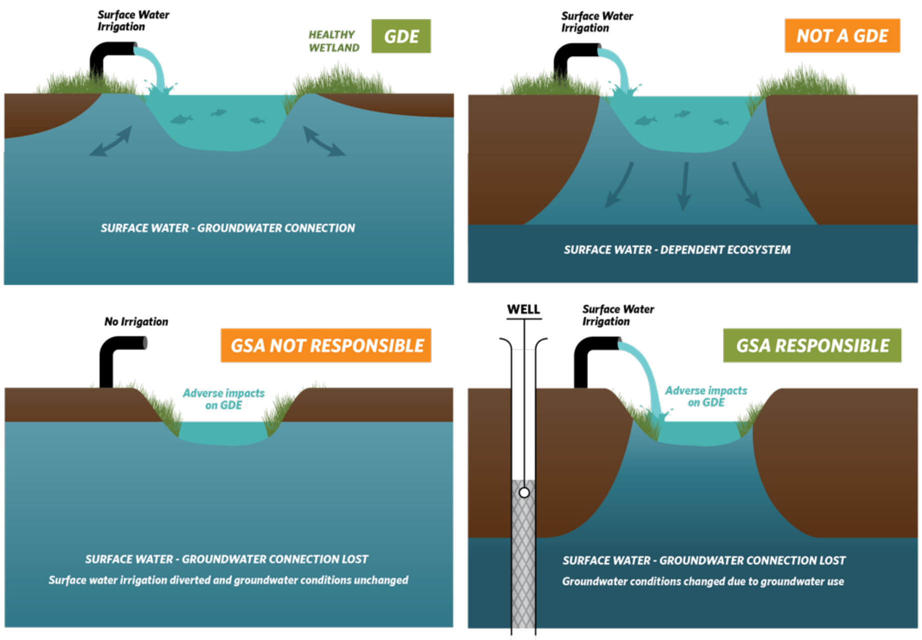

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

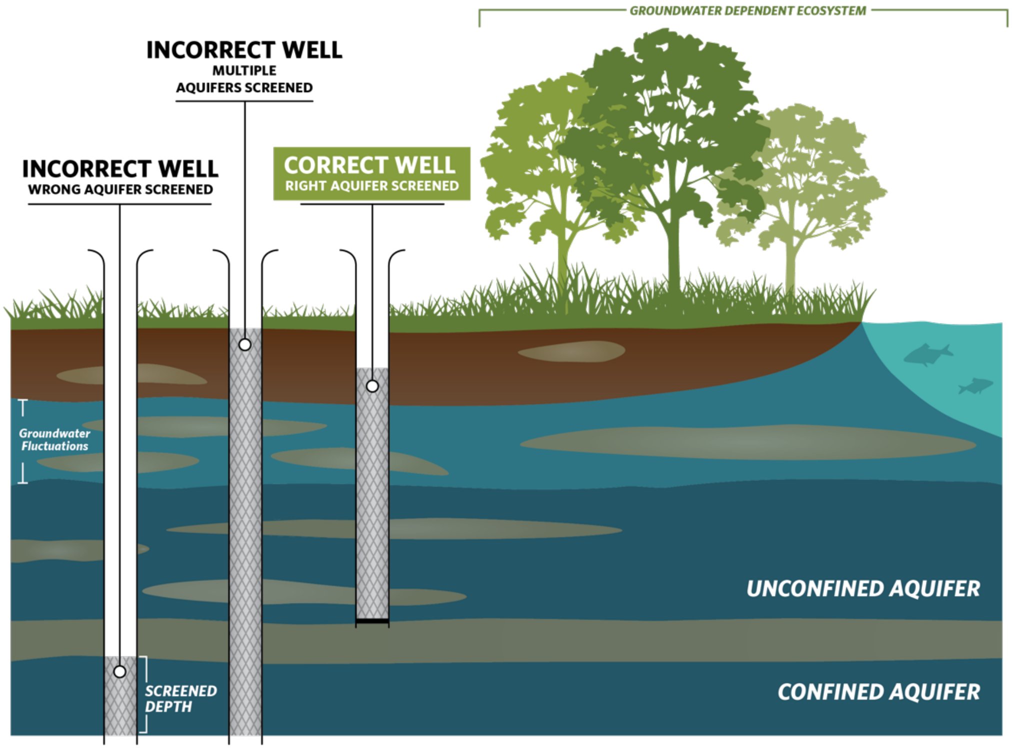

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

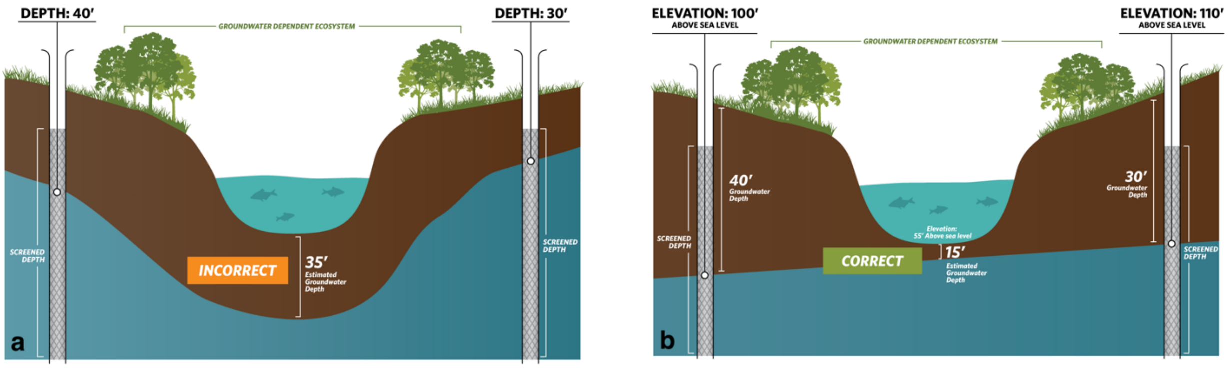

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

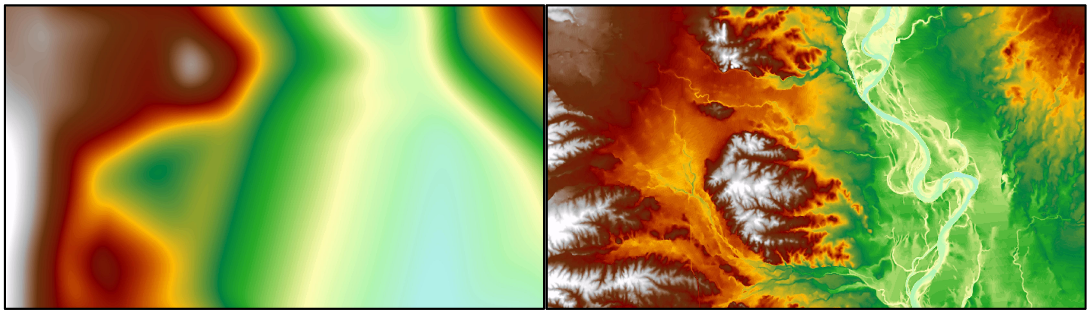

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

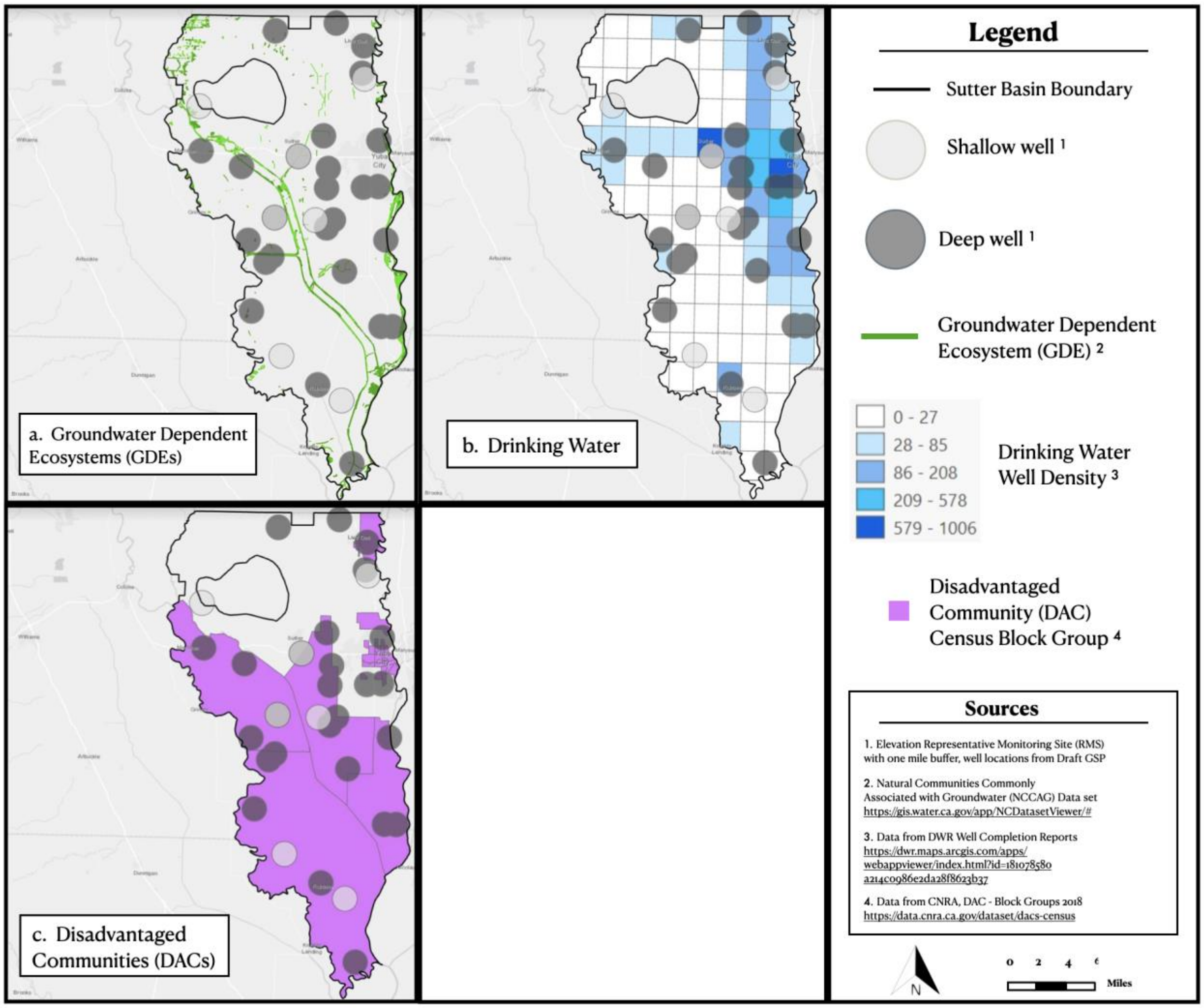

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

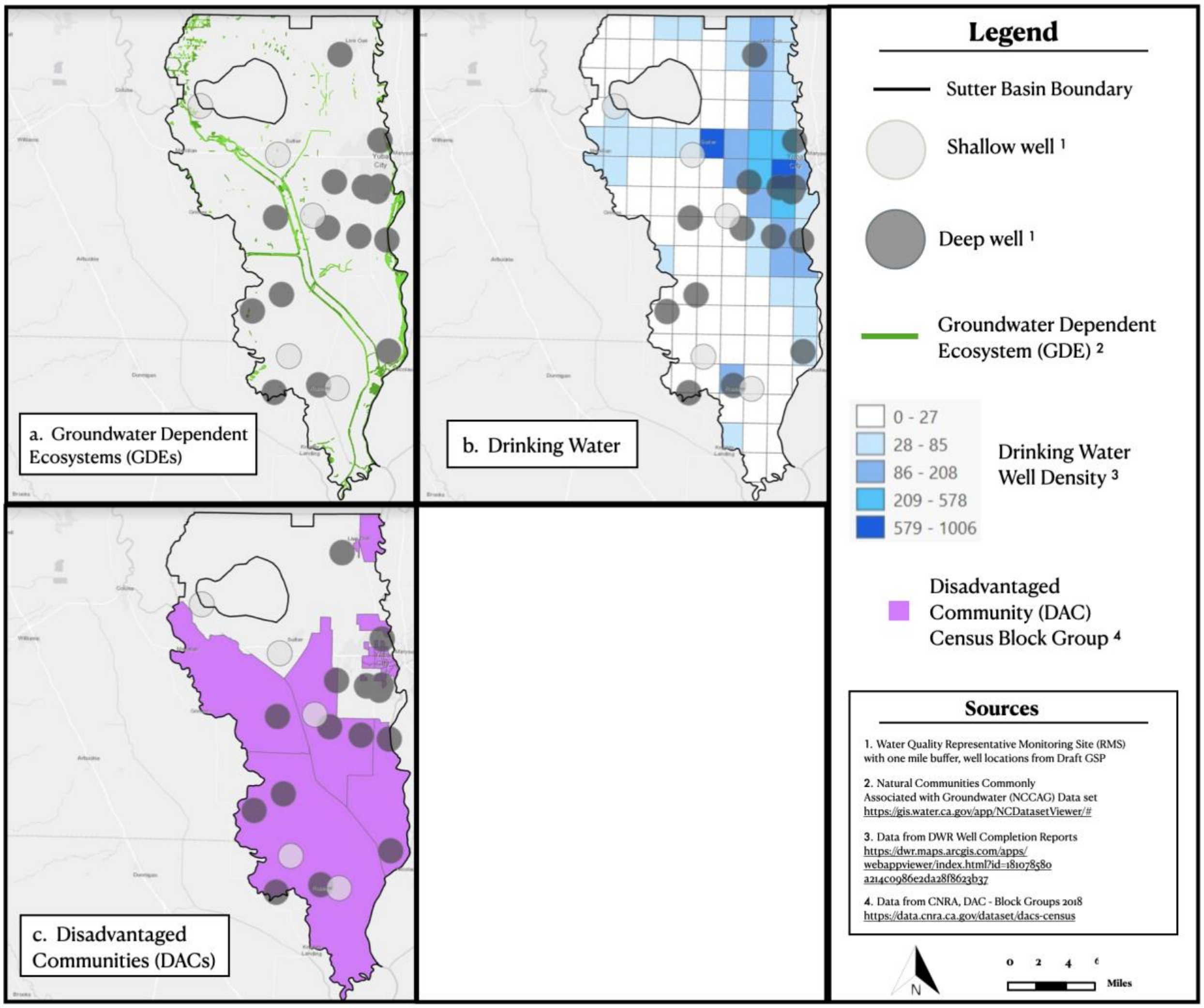

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

December 14, 2021

Temescal GSA
755 Public Safety Way
Corona, CA 92878

Submitted via email: Groundwater@coronaca.gov

Re: Public Comment Letter for Temescal Basin Draft GSP

Dear Melissa Estrada-Maravilla,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Temescal Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Temescal Basin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Temescal Basin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP provides information on DACs, including identification by name and location on a map (Figure 2-13). However, the GSP fails to clearly state the population of each DAC.

The GSP provides a density map of domestic wells in the basin (Figure 2-5). However, the plan fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the basin. This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the basin.

These missing elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide the population of each identified DAC. • Include a map showing domestic well locations and average well depth across the basin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP describes the use of aerial photos to analyze stream reaches and presents analysis of stream gage and groundwater elevation data. The ISW section concludes with the following statement (p. 4-16): *"In spite of these accuracy limitations, contours of depth to water measured in wells—in combination with depth to water data*

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

for the downstream end of the Bedford-Coldwater Subbasin (also shown in Figure 4-20) —indicates that there are only two areas in or near the Basin where depth to water is likely shallow enough to be within the root zone of vegetation or possibly discharge into stream channels or wetlands (Figure 4-20). One of the areas is the 2-mile bedrock reach of Temescal Wash between the Bedford-Coldwater Subbasin and Basin, and the other is the Prado Wetlands, where contouring suggests groundwater discharges into the wetlands. Depth to water in spring of 2017 was less than 20 feet downstream of about North Lincoln Avenue." The spring 2017 depth to water data are the only data discussed when referring to depth to water. However, using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs. The use of data from one point in time does not reflect the temporal (seasonal and interannual) variability inherent in California's climate.

On the map of stream reaches in the basin (Figure 4.17 Regional Surface Water Features), the reaches are not labeled as interconnected and disconnected, nor are areas with data gaps noted. Therefore, potential ISWs are not being identified, described, nor managed in the GSP. Until a disconnection can be proven, include all potential ISWs in the GSP. This is necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water.

RECOMMENDATIONS

- Provide a map showing all the stream reaches in the basin, with reaches clearly labeled as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.

- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.

- Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

- Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **incomplete**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, the GDE section of the GSP could be improved by more clearly describing and mapping the basin's GDEs to show the data sources and areas of data gaps. Figure 4-21(Critical Habitat Areas) shows a map layer called "NCCAG riparian vegetation," however based on the description in the text, it is not clear if this is the entire NC dataset or if any screening criteria were used to modify the mapped potential GDEs. The GSP text (p. 4-17) discusses the corridor of dense riparian trees and shrubs along the bedrock reach of Temescal Wash between the Bedford-Coldwater Subbasin and the Temescal Basin, but does not explicitly state the data source (i.e., field verification) or whether this vegetation is included in the set of potential GDEs. Data gaps are described in the text, but the areas of data gaps are not clearly labeled on the map.

The GSP discusses trends in groundwater elevations over the period 2010 to 2020 and plots a limited set of hydrographs over this period in Figure 4-23. However, the only depth to groundwater contours show are from Spring 2017. The GSP could be improved by mapping depth to groundwater contours over multiple years and seasons to illustrate the temporal (seasonal and interannual) variability inherent in California's climate.

RECOMMENDATIONS

- Provide a comprehensive set of maps for the basin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained, removed, or added to/from the NC dataset (include the removal reason if polygons are not considered potential GDEs, or include the data source if polygons are added). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps from multiple seasons and water year types (e.g., wet, dry, average, drought), noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included into the water budget.[2,3] The integration of these ecosystems into the water budget is **insufficient**. Appendix I (Temescal Groundwater Sustainability Plan Numerical Groundwater Model Documentation Report) that accompanies the water budget section of the GSP was not included in the published version of the Draft GSP. Without this Appendix of the GSP, which documents the water budgets, we could not evaluate whether the water budget includes the current, historical, and projected demands of native vegetation. Inclusion of the explicit demands for native vegetation is essential so that key environmental uses of groundwater are being accounted for as water supply decisions are made using this budget and considered in project

[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.

- State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Outreach and Stakeholder Involvement Communications Plan (Appendix D).[4]

The GSP documents targeted outreach to DACs, including distribution of SGMA Fact Sheets through local churches and community centers; Spanish translation of materials and interpretation at events; and meetings with community leaders, community action organizations, and elected officials. However, we note the following deficiencies with the overall stakeholder engagement process:

- The GSA's Technical Advisory Committee fails to include representation from DACs and environmental stakeholders in the basin.

- Aside from the details of the Technical Advisory Committee, the GSP documents opportunities for public involvement and engagement in general terms. These include communication and engagement through the GSP webpage, outreach materials, communication through social media, websites, and email, and public workshops. The plan lacks specific details of outreach and engagement targeted to environmental stakeholders.

- The plan fails to document the outcome of the outreach and engagement conducted, nor does it document how information obtained from beneficial users was incorporated into the GSP development process.

- The GSP describes plans for Technical Advisory Committee meetings to continue during the implementation phase of the GSP. However, the GSP does not include a detailed plan for continual opportunities for engagement outside of these meetings through the *implementation* phase of the GSP that is specifically directed to DACs, domestic well owners, and environmental stakeholders within the basin.

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

RECOMMENDATIONS
• In the Outreach and Stakeholder Involvement Communications Plan, describe active and targeted outreach to engage all stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. • Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the basin.[5]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, minimum thresholds are defined at each representative well as historical groundwater low levels. The GSP discounts private domestic wells when establishing SMC, based on the following rationale (6-6): *"There are very few active private wells in the Basin (see Section 2.3.2.1). The owners and operators of those wells are known and they have not reported any adverse effects to those wells in the past; None of the existing private well owners report that their wells went dry or were otherwise affected during the recent drought. Because of this, some flexibility exists for purposes of analysis; Responsibility for potential undesirable results to shallow wells is shared between a GSA and a well owner; there is a reasonable expectation that a well owner would construct, maintain, and operate the well to provide its expected yield over the well's life span, including droughts; As discussed below, MTs are initially set at historical groundwater level lows and then adjusted upward to be protective."* No further details are provided regarding the minimum threshold impacts on domestic wells. The GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs or drinking water users when defining undesirable results, nor does it describe how the groundwater levels minimum thresholds are consistent with Human Right to Water policy.[9]

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[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

For degraded water quality, constituents of concern (COCs) are total dissolved solids (TDS) and nitrate. The minimum threshold for nitrate is defined as the percentage of wells with concentrations exceeding the nitrate MCL (45 mg/L) based on current conditions (2015-2019), which is 50% of wells. The minimum threshold for TDS is defined as the percentage of wells with concentrations exceeding the TDS value of 1,000 mg/L based on current conditions (2015-2019), which is 26 percent of wells. However, according to the state's anti-degradation policy,[10] water quality should be protected and is only allowed to worsen if a finding is made that it is in the best interest of the people of the State of California. No analysis has been done and no such finding has been made.

The GSP states (p. 6-25): *"Other constituents have been documented (see Groundwater Conditions Section 4.8) but occurrences of these are either under regulation by RWQCB (e.g., perchlorate) or are naturally occurring with no recent exceedances of MCLs and limited potential for mobilization due to management actions (e.g., arsenic, chromium, iron, and manganese)."* However, all COCs in the basin that may be impacted or exacerbated by groundwater use and/or management should be included in the SMC, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users and DACs when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users and DACs within the basin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be fully or partially de-watered at the minimum threshold.

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users and DACs when defining undesirable results for degraded water quality.[11] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[12]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users and DACs.

[10] Anti-degradation Policy
https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf
[11] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]
[12] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act
https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

- Set minimum thresholds and measurable objectives for all water quality constituents within the basin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management.
- Set minimum thresholds that do not allow water quality to degrade to levels at or above the MCL trigger level.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the basin, they must be considered when developing SMC.

For depletion of interconnected surface waters, SMC are only established for the Prado Wetlands area. Our comments above in the ISW section of this letter note that interconnected surface waters have not been sufficiently identified and mapped in the basin. Therefore, SMC for depletion of interconnected surface waters may disregard some of the ISWs in the basin.

For the Prado Wetlands area, SMC are established as follows (p. 6-34): *"The Minimum Threshold for depletion of interconnected surface water is the amount of depletion that occurs when the depth to the water along the southern edge of the Prado Wetlands is greater than 15 feet for a period exceeding one year. This threshold corresponds approximately to the maximum depth to water measured in shallow monitoring wells in the northern part of the Prado Wetlands."* However, if minimum thresholds are set to historic low groundwater levels and the basin is allowed to operate at or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse. No analysis or discussion is presented to describe how the SMC will affect beneficial users, and more specifically GDEs, or the impact of these minimum thresholds on GDEs in the basin. Furthermore, the GSP makes no attempt to evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the basin (see Attachment C for a list of environmental users in the basin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- Evaluate impacts on GDEs when establishing SMC for chronic lowering of groundwater levels. When defining undesirable results, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the basin.[13] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[14]

- Re-evaluate the extent of ISWs in the basin. When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the basin are reached.[15] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,16]

- When establishing SMC for the basin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[17] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[18] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the basin. While these extreme scenarios may

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[13] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[14] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[15] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]
[16] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf
[17] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]
[18] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

The GSP appears to integrate climate change into key inputs (e.g., changes in precipitation and evapotranspiration) of the rainfall-runoff-recharge model. However, this could not be confirmed since the details of the described rainfall-runoff-recharge model included in Appendix I were not included for review in the Draft GSP. Furthermore, water is imported into the basin, but these inputs are not quantified and included in the surface water flow volumes of the water budget tables and it is unclear if these inputs are adjusted for climate change.

The sustainable yield is calculated based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of extreme climate scenarios as well as the omission of projected climate change effects on key inputs (e.g., precipitation, evapotranspiration, imported water flows), then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Ensure that Appendix I, including a description of the rainfall-runoff-recharge model, is included in the GSP.
- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Integrate climate change into precipitation and evapotranspiration inputs and include the values in the projected water budget tables.
- Integrate climate change into surface water flow inputs, including imported water, for the projected water budget.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Wells (RMWs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around domestic wells, GDEs, and ISWs in the basin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[19]

Figure 7-1 (Groundwater Level Monitoring Wells) shows insufficient representation of GDEs and drinking water users for groundwater elevation monitoring. Figure 7-2 (Water Quality Monitoring Wells) shows

[19] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

insufficient representation of drinking water users for water quality monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater.

The GSP includes plans to install three shallow monitoring wells near the Prado Wetlands to monitor GDEs in this area. However, our comments above note that since this is the only area of the basin where SMC to protect ecosystems have been established, the GSP disregards other areas of the basin where GDEs and ISW may exist. Additional monitoring may be needed to adequately assess the presence of GDEs and ISWs and to monitor the impact of SMC on these ecosystems.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify monitored areas.
- Increase the number of RMWs in the shallow aquifer across the basin as needed to map ISWs and adequately monitor all groundwater condition indicators across the basin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMWs.
- Ensure groundwater elevation and water quality RMWs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.
- Further describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the basin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.
- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[20]

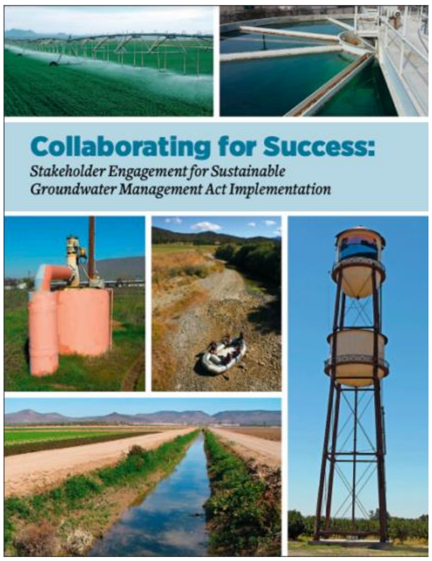
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[20] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

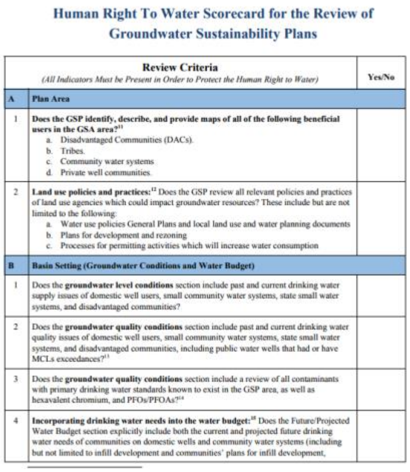
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

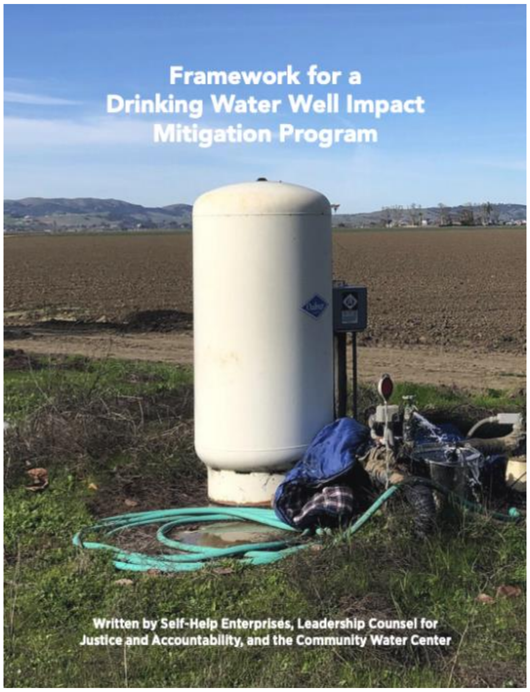


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

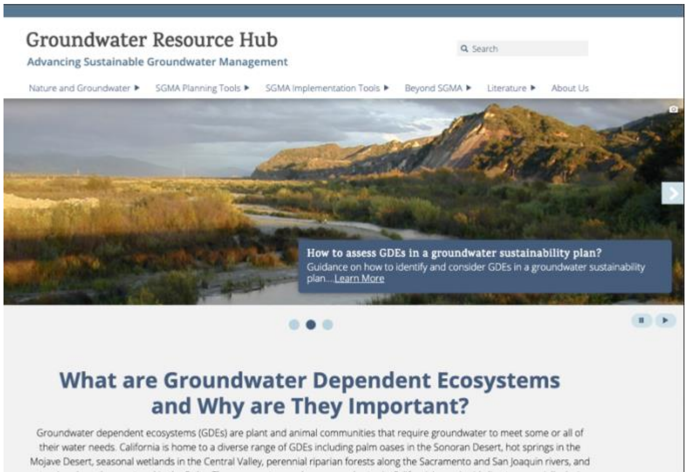
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



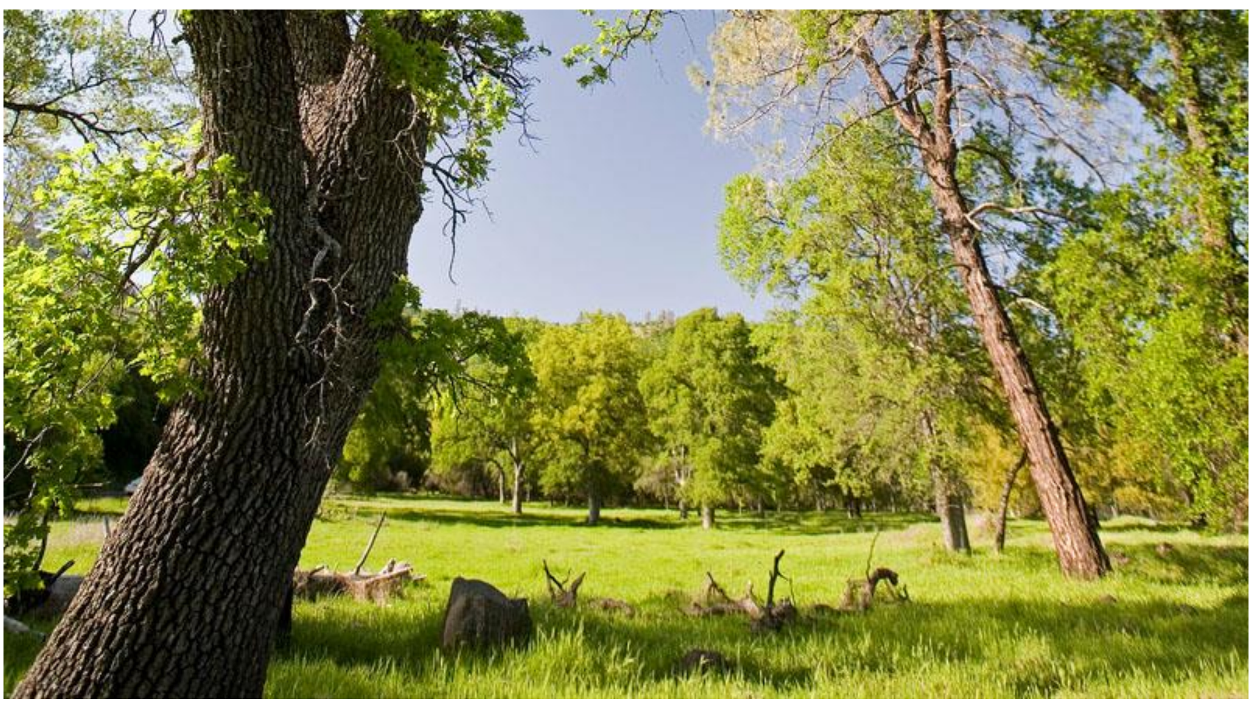
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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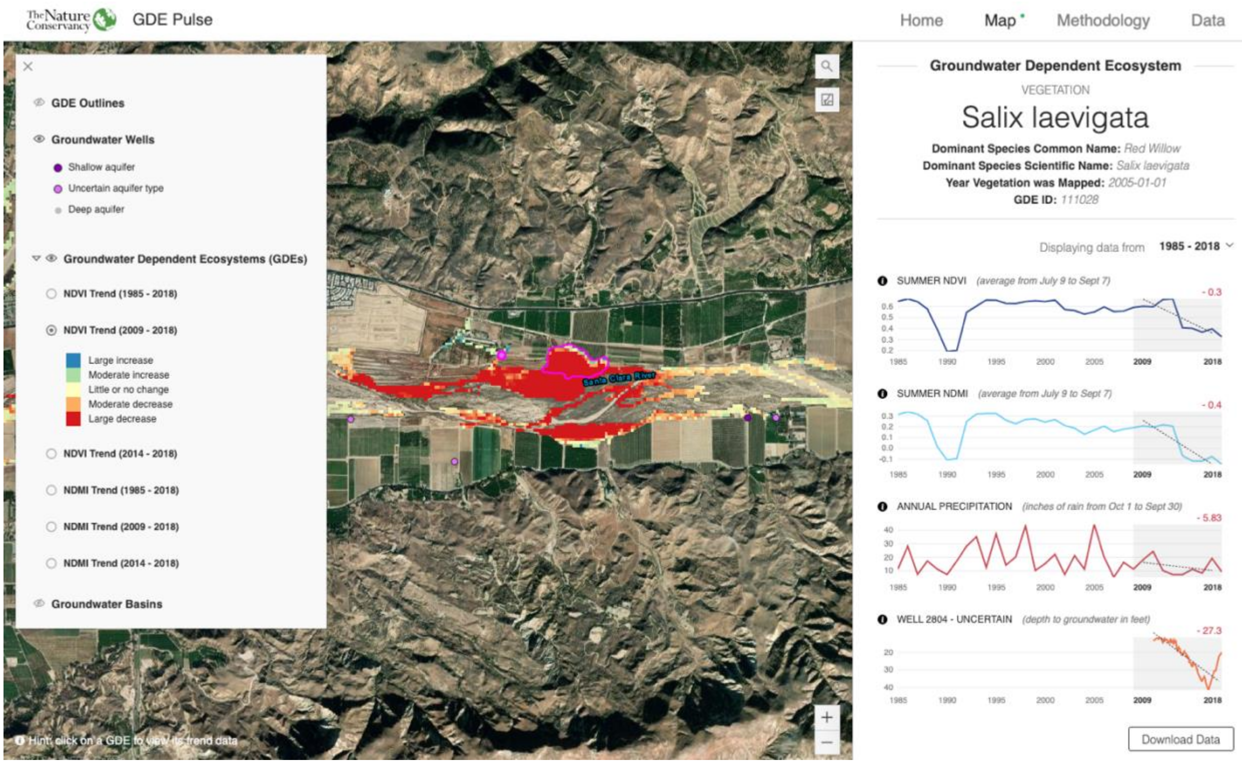
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

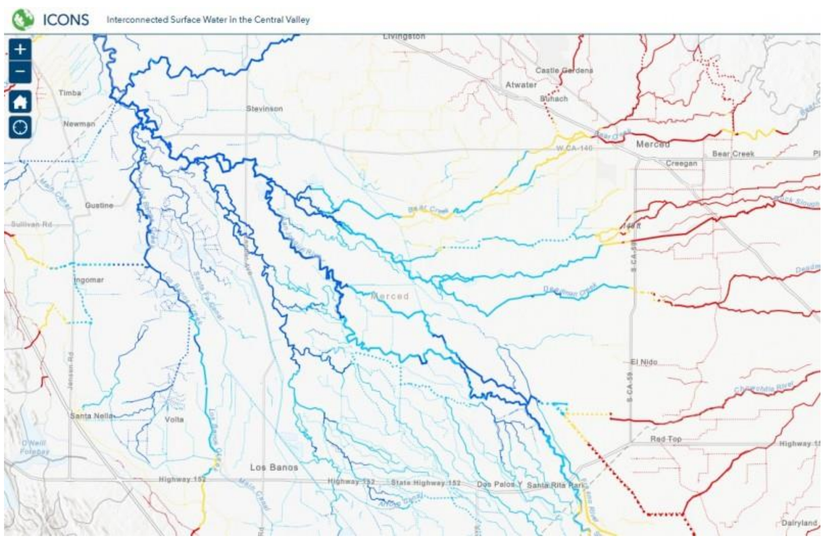
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Temescal Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Temescal Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Aechmophorus clarkii	Clark's Grebe			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Candidate - Threatened	Endangered	
Egretta thula	Snowy Egret			
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Megaceryle alcyon	Belted Kingfisher			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Phalacrocorax auritus	Double-crested Cormorant			
Plegadis chihi	White-faced Ibis		Watch list	
Podiceps nigricollis	Eared Grebe			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Vireo bellii	Bell's Vireo			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
CRUSTACEANS				
Hyalella spp.	Hyalella spp.			
FISH				
Catostomus santaanae	Santa Ana sucker	Threatened	Special Concern	Endangered - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern	ARSSC
Pseudacris cadaverina	California Treefrog			ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC

Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Apedilum spp.	Apedilum spp.			
Chaoboridae fam.	Chaoboridae fam.			
Chironomus spp.	Chironomus spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Ephydridae fam.	Ephydridae fam.			
Fallceon spp.	Fallceon spp.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Nanocladius spp.	Nanocladius spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Psychodidae fam.	Psychodidae fam.			
Simulium spp.	Simulium spp.			
Thienemannimyia spp.	Thienemannimyia spp.			
MOLLUSKS				
Gyraulus spp.	Gyraulus spp.			
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
PLANTS				
Arundo donax	NA			
Baccharis salicina				Not on any status lists
Marsilea vestita vestita	NA			Not on any status lists

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

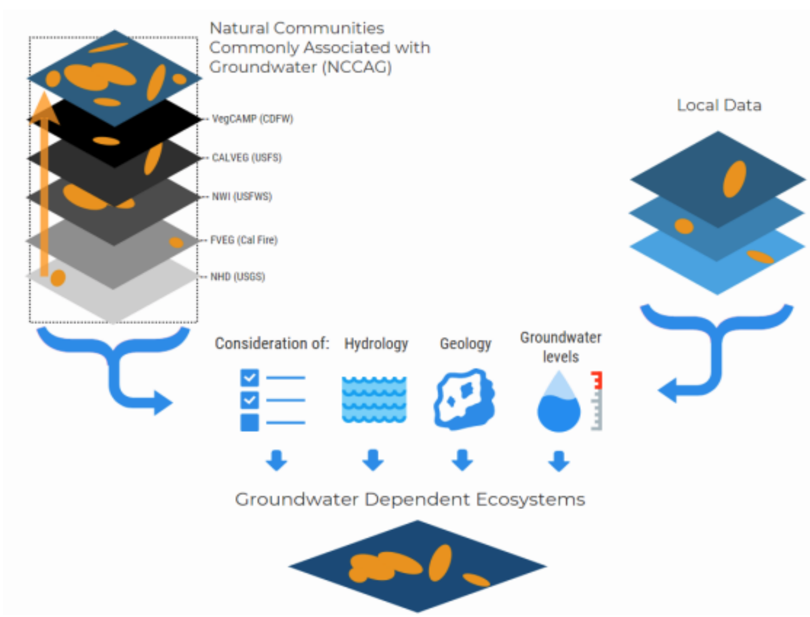


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

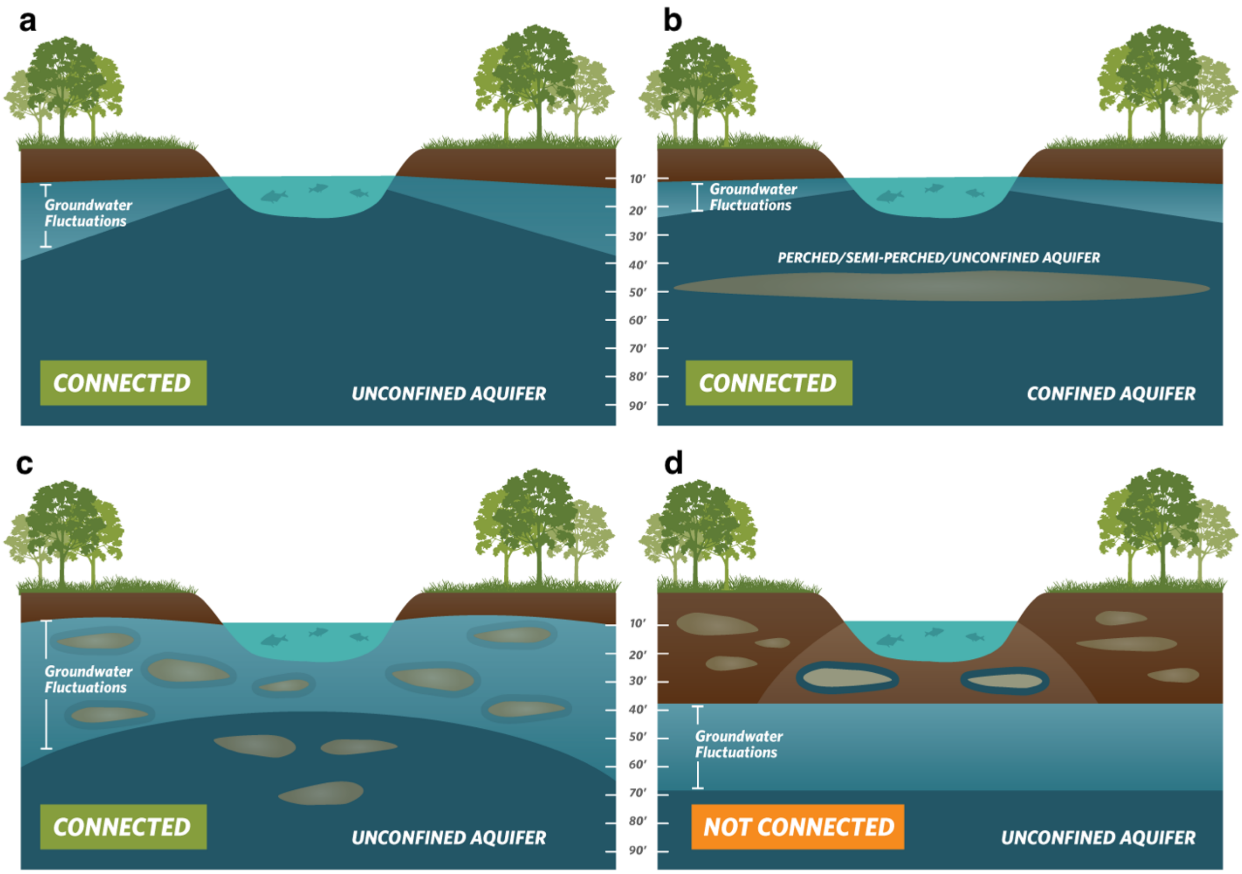


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

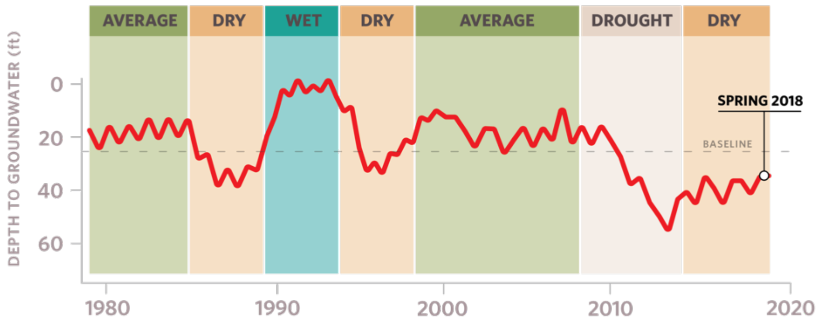


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

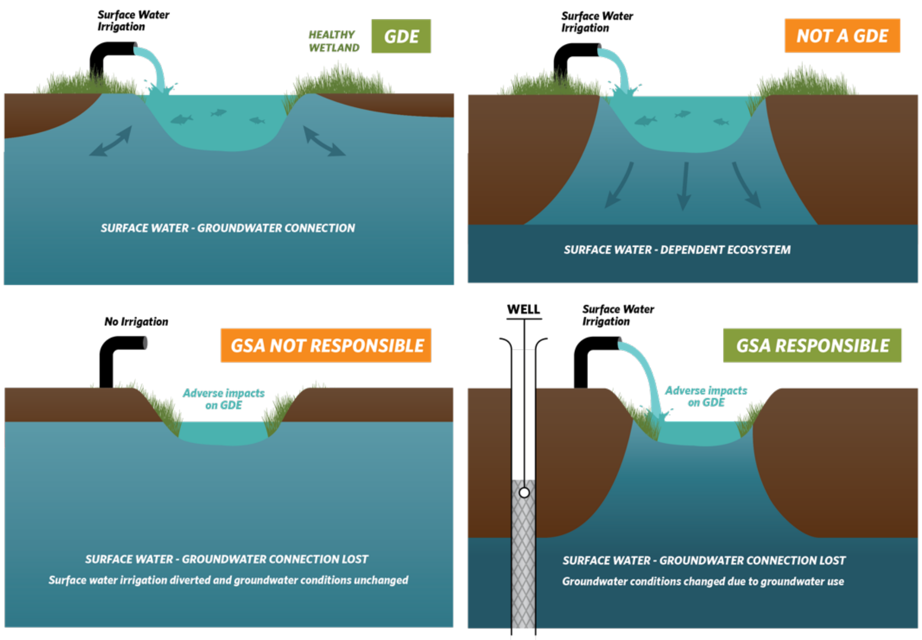


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

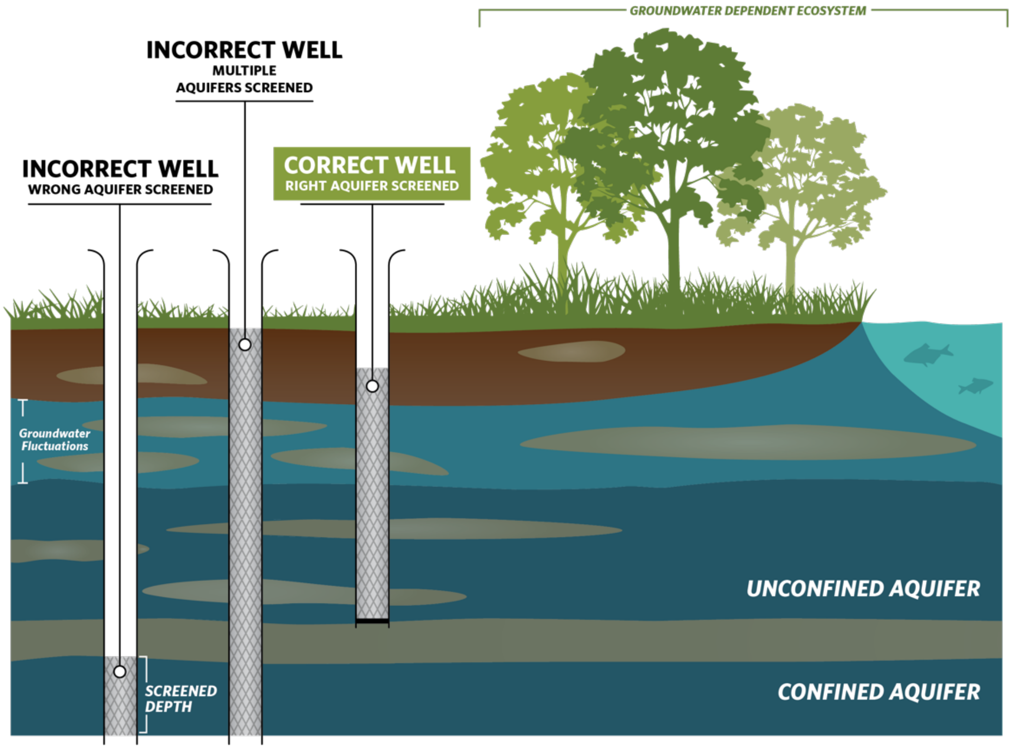


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

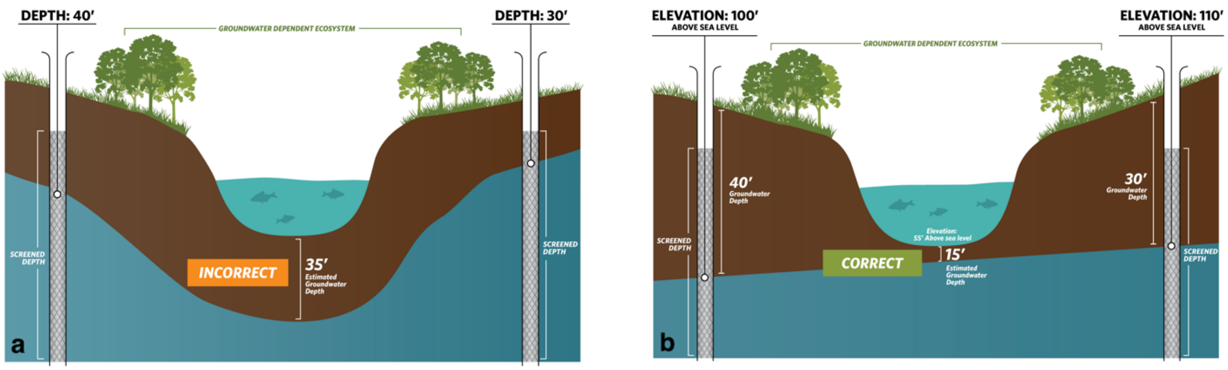


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

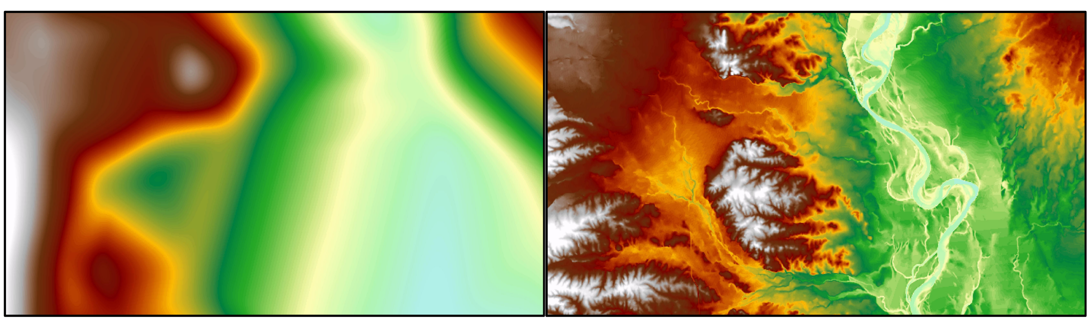


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

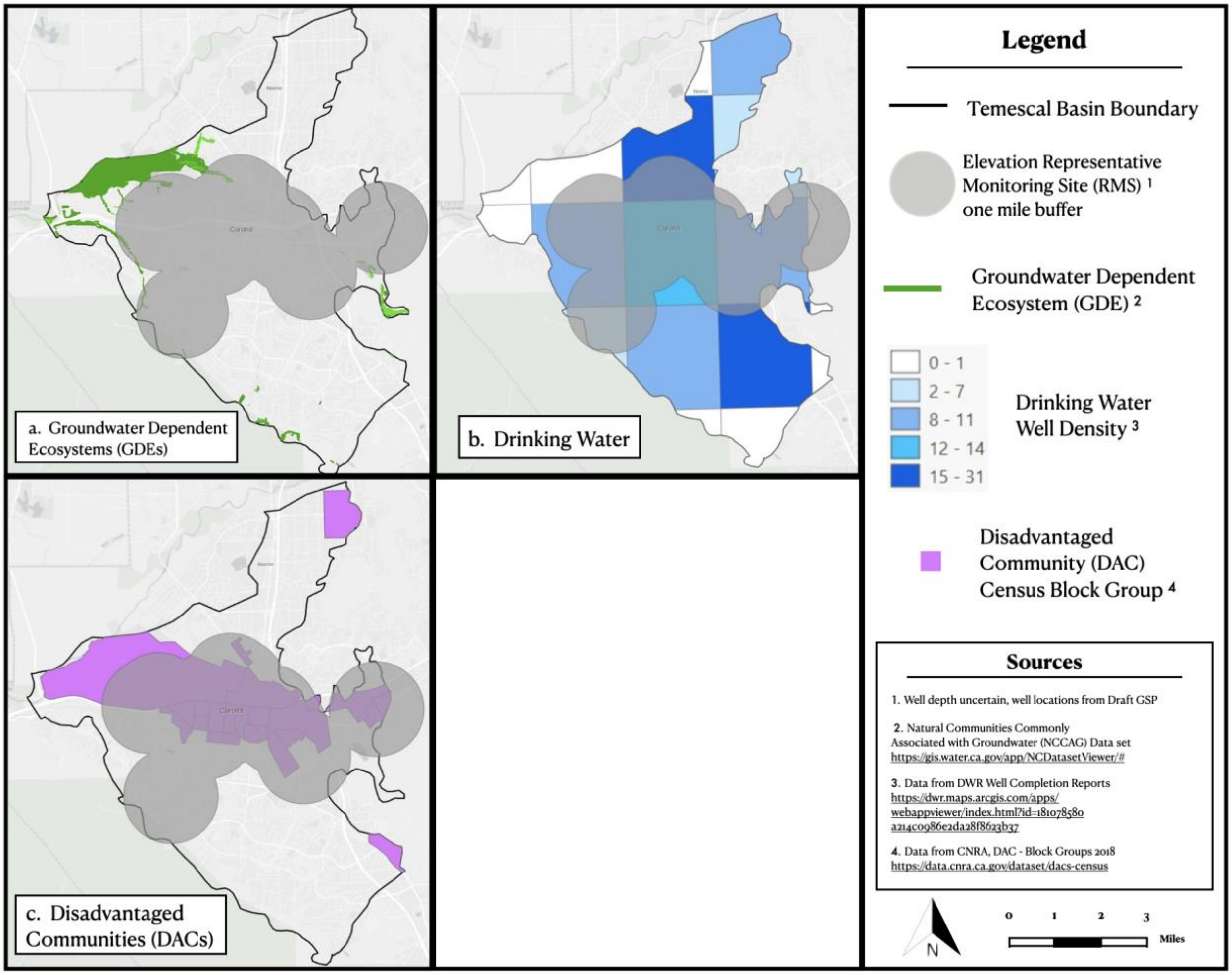


Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

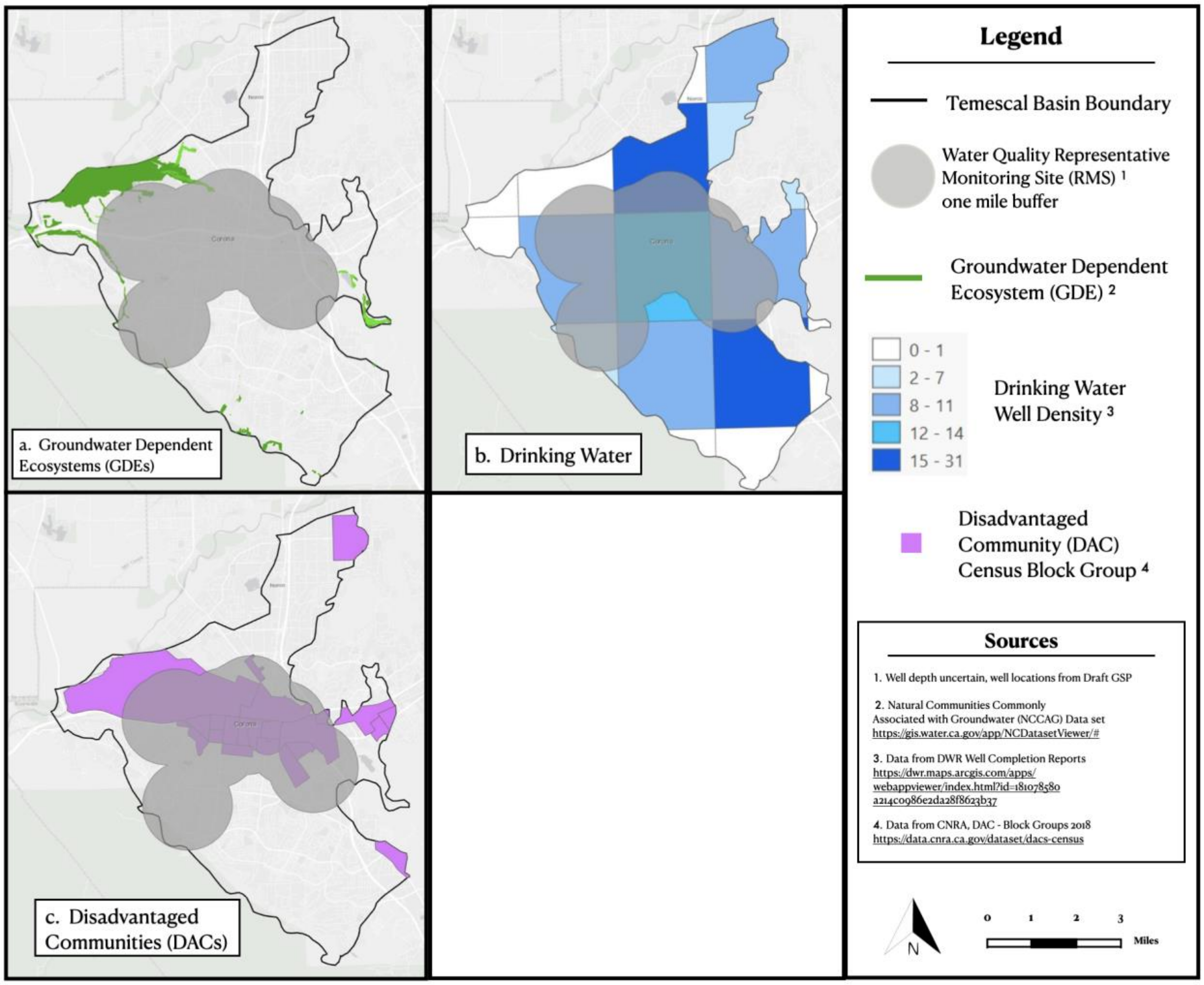


Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

September 9, 2021

Tracy Subbasin Groundwater Sustainability Agencies
c/o San Joaquin County
1810 E. Hazelton Avenue
Stockton, CA 95201

Submitted via email: mzidar@sjgov.org

Re: Public Comment Letter for Tracy Subbasin Draft GSP

Dear Matt Zidar,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Tracy Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Tracy Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the subbasin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Tracy Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**, based on lack of identification of the population size of DACs in the subbasin.

The GSP provides a map of DAC and SDAC locations (Figure 3-17) and identifies DACs by census tracts (Table 11-1). The GSP also provides adequate mapping of the location of all domestic wells by location and by depth (Figure 3-14) and the density of domestic wells in the subbasin (Figure 3-13). The GSP identifies the sources of water for DACs and what percentage is supplied by groundwater. However, the missing population size element is required for the GSA to fully understand the specific interests and water demands of these beneficial users, to support the development of water budgets using the best available information, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS
• Provide the size of the population in each DAC.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**. The GSP states (p. 5-72): "The creeks in these areas [the lands south of the Old River and Tom Paine Slough] are perennial, not flowing year-round, and therefore the surface water in this area is not considered to be interconnected to groundwater." There are two problems with this sentence. First, a perennial stream is one that does flow year round. Second, this sentence contradicts the the first sentence of the ISW section on p. 5-72, which states: "Interconnected surface water refers to surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted (CCR 2014)." The phrase "at any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

Figure 5-40 shows the locations of monitoring wells and their hydrographs used to verify the ISW analysis, however the stream reaches are not labeled on this figure, nor is any analysis provided in the text. Furthermore, no backup analysis is provided for the use of the 20-ft criteria provided in the text. The GSP cites Appendix K (Surface Water/Groundwater Interaction Hydrographs) as evidence that when depth to water is less than 20 feet, the surface water can be inferred to be interconnected to the upper aquifer. This appendix, however, is missing.

Because potential ISWs have not been identified, they cannot be adequately managed in the GSP. Until a disconnection can be proven, include all potential ISWs in the GSP. This is necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water.

RECOMMENDATIONS
- Provide a map showing all the stream reaches in the subbasin, with reaches clearly labeled with stream name and interconnected or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.   - Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.   - Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs.   - Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP. Data gaps are discussed in general terms on p. 5-78, but very little detail is provided.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of comprehensive, systematic analysis of the subbasin's GDEs. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). We commend the GSA for retaining all of the NC dataset polygons in the subbasin as potential GDEs. However, the GSP did not verify the NC dataset with the use of groundwater data from the underlying principal aquifer. Without an analysis of groundwater data to verify the NC dataset polygons, it will be difficult or impossible to adequately monitor and manage the GDEs throughout GSP implementation.

RECOMMENDATIONS
• Overlay GDE locations with depth-to-groundwater contour maps. For these contour maps, note the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth to groundwater contours across the landscape. • Use depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included into the water budget. The integration of these ecosystems into the water budget is **sufficient**. We commend the GSA for including and showing the groundwater demands of these ecosystems in the historical, current and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **incomplete**. SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the GSP. The GSP references Appendix P for the Tracy Subbasin Communication and Engagement Plan, however only a placeholder for Appendix P is included in the Draft GSP. While the main text describes how DACs and environmental stakeholders were given opportunities to engage in the GSP development process, the GSP should be improved by including a separate Communication and Engagement Plan that describes outreach to DACs and environmental stakeholders during the GSP *implementation* phase, in addition to the GSP development phase.

[1] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[2] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[3] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

RECOMMENDATIONS

- Include a robust Communication and Engagement Plan.
- Describe efforts to engage with stakeholders during the GSP *implementation* phase in the Communication and Engagement Plan. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the subbasin are required when defining undesirable results[4] and establishing minimum thresholds.[5,6]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs or domestic drinking water wells when defining undesirable results. The GSP does not sufficiently describe how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results in the subbasin. For undesirable results, the plan states that "[t]he level when there would be a significant undesirable result will be when 25 percent or more of the representative monitoring wells record groundwater levels that exceed the minimum thresholds for more than 2 consecutive years excluding drought periods." The GSP failed to include periods of drought.

For degraded water quality, SMCs were developed for three of the constituents of concern (COCs) in the subbasin: TDS, nitrate, and boron. SMCs were not developed for the other stated COCs (sulfate, 1,2,3-TCP, and arsenic). Where concentrations are above the maximum contaminant level (MCL) or agricultural water quality objective, minimum thresholds were established at 10% higher than the maximum concentrations historically found at representative monitoring wells. The increase of 10% above the historical levels was developed based on uncertainty in concentrations and due to concentrations in some wells having upward trends (p. 9-18). This method of establishing minimum thresholds is not protective of DACs or drinking water users.

[4] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
[5] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[6] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs and drinking water users within the subbasin. Further describe the impact of passing the minimum threshold for drinking water users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.
- Include and consider periods of drought when defining undesirable results for the basin.

Degraded Water Quality

- Describe direct and indirect impacts on DACs when defining undesirable results for degraded water quality. For specific guidance on how to consider domestic water users, refer to “Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act.”[7]
- Evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs and drinking water users.
- Set minimum thresholds at the MCL for TDS, nitrate, and boron, instead of 10% higher than the MCL at some wells.
- Set minimum thresholds for the additional COCs: sulfate, 1,2,3-TCP, and arsenic. Ensure they align with drinking water standards[8].

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP uses historic low groundwater levels (typically those that occurred during the 2012-2016 drought) as a proxy to establish minimum thresholds for the depletions of interconnected surface water. The GSP assumes that historical conditions are protective of beneficial uses related to interconnected surface water. However, the true impacts to ecosystems under this scenario are not discussed. If minimum thresholds are set to historic low groundwater levels and the subbasin is allowed to operate just above or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that is more adverse than what was occurring during the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. If the drought conditions are prolonged however, the ecosystem can collapse. While ecosystems may have been only water stressed during the recent drought, they could be inadvertently destroyed if groundwater conditions are maintained at or just above those levels in the long-term, since the subbasin would be permitted to sustain extreme dry conditions over multiple seasons and years.

[7] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[8] “Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues.” [23 CCR §354.34(c)(4)]

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[9] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[10] can be determined.

- For the interconnected surface water SMC, the undesirable results should include a description of potential impacts on instream habitats within ISWs when defining minimum thresholds in the subbasin[11]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,12].

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[13] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2070. However, the GSP did not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower

[9] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[10] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[11] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]
[12] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf
[13] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

The GSP includes climate change into precipitation and evapotranspiration terms of the projected water budget. Surface water deliveries, however, were not adjusted for climate change. Furthermore, the GSP does not calculate a sustainable yield based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems and DACs.

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate surface water flow inputs that are adjusted for climate change to the projected water budget.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**. The representative monitoring sites (RMSs) do not adequately represent water quality conditions or groundwater elevation conditions in the northern DAC communities of the Tracy subbasin. Only one new monitoring well is proposed to supplement the GDE analysis, despite the lack of existing shallow wells to monitor GDEs.

The RMSs for surface water depletion monitoring are located only in the southern half of the subbasin (Figure 8-11). The GSP states (p. 8-25): “Monitoring wells along tributaries were not selected as the tributaries only flow for short periods after rain events and are not connected by a continuous saturated interval with the principal aquifers.” As discussed above in the ISW section, this shows a disregard for potential ISWs in the subbasin.

The lack of shallow monitoring wells and the lack of plans for future monitoring threatens GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Potential GDEs are located in areas of the subbasin where no shallow groundwater monitoring currently exists or is proposed, leaving data gaps unfilled. Potential ISWs have been dismissed in the GSP, without proposed recommendations to improve ISW identification, mapping, and estimates of depletions. Appropriate monitoring is necessary so that groundwater conditions are characterized and surface-shallow groundwater interactions are fully integrated into the GSP.

RECOMMENDATIONS

- Provide maps that overlay monitoring well locations with the locations of DACs and GDEs to clearly identify potentially impacted areas. Increase the number of representative monitoring sites (RMSs) across the subbasin for all groundwater condition indicators.

- Reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs, and identify DACs and shallow domestic well users that are vulnerable to undesirable results.

- Determine what ecological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions in the GSP is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for all beneficial users.

RECOMMENDATIONS

- Recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the “Multi-Benefit Recharge Project Methodology Guidance Document”[14].

- For all beneficial users, provide public notice and engagement before consideration and implementation of the management actions and projects identified.

- For DACs and domestic well owners, include discussion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

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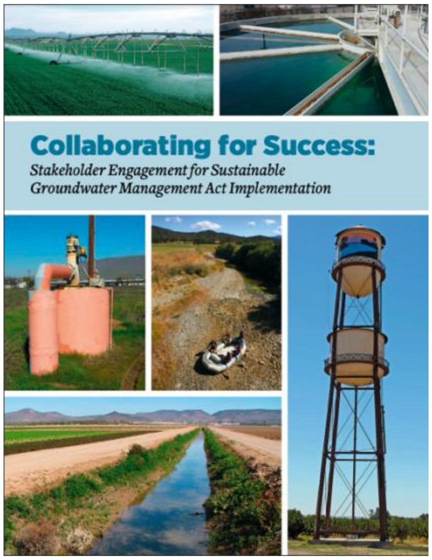
[14] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

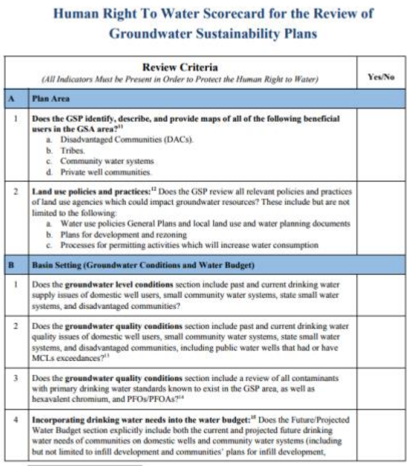
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

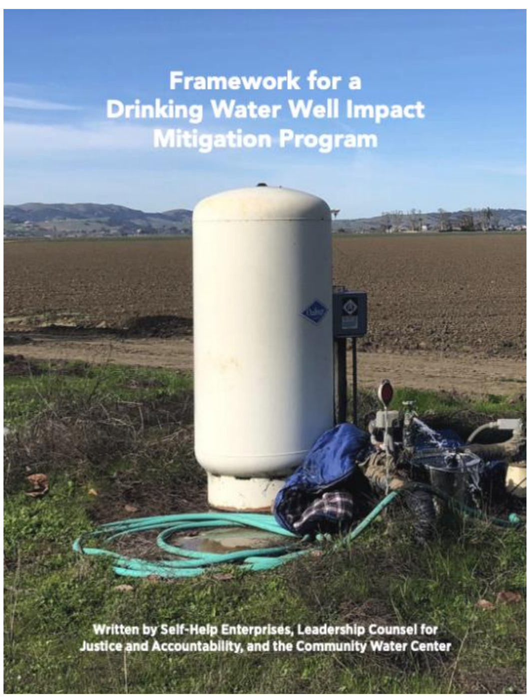


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

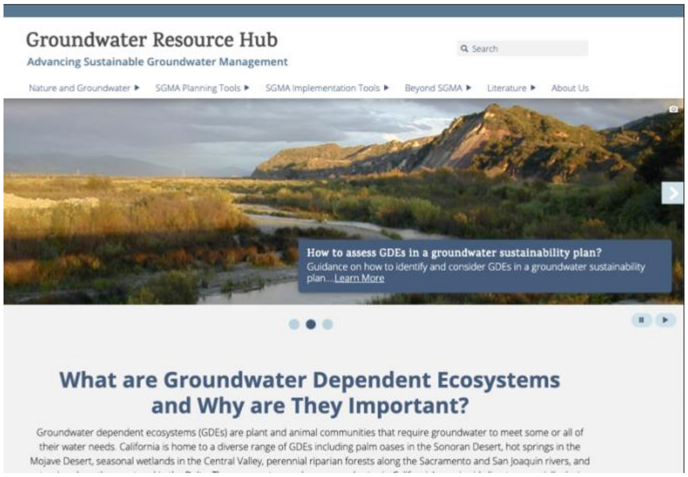
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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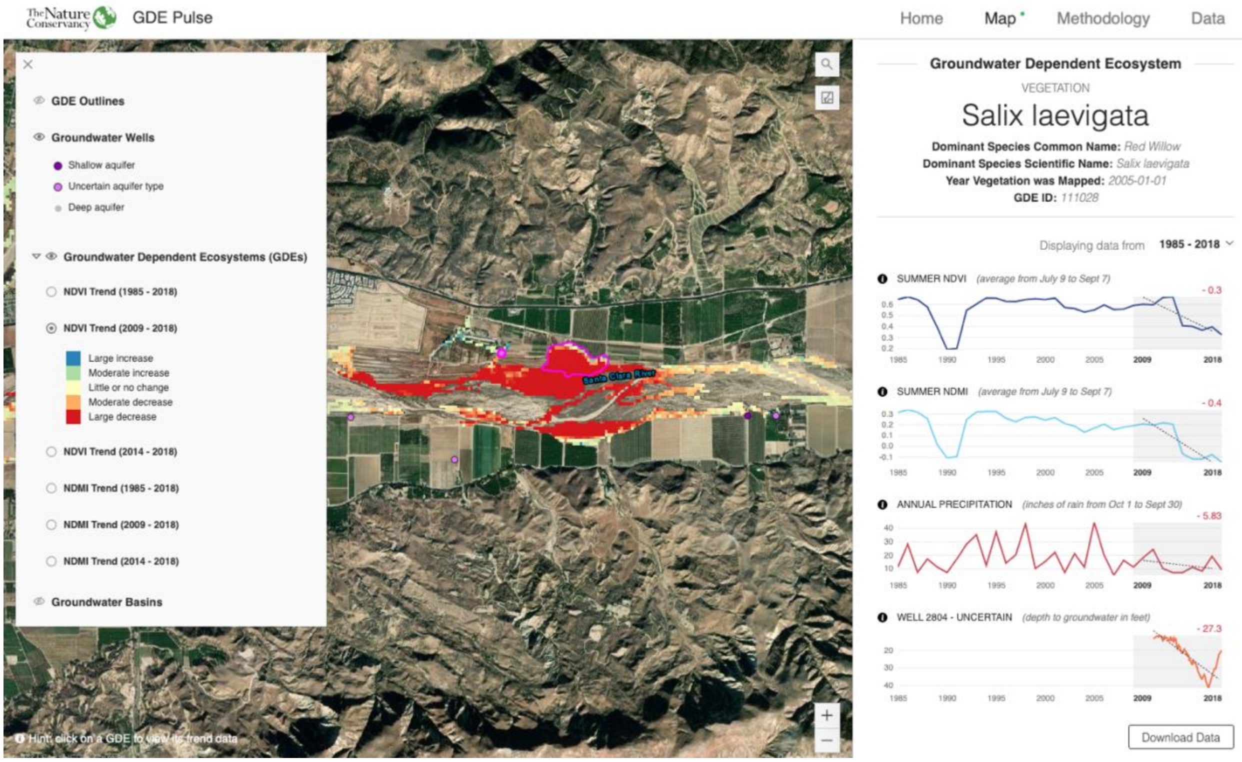
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

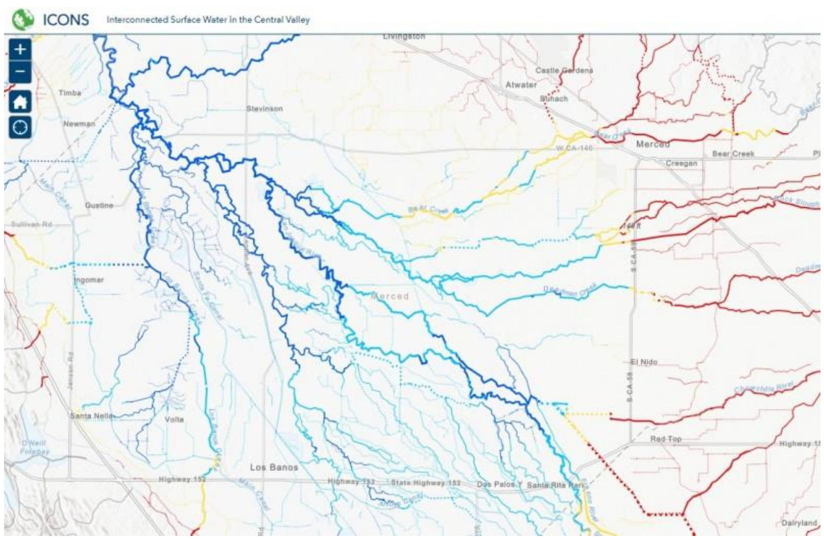
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data [available online](#) from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Tracy Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Tracy Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Laterallus jamaicensis coturniculus	California Black Rail	Bird of Conservation Concern	Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Histrionicus histrionicus	Harlequin Duck		Special Concern	BSSC - Second priority
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			

Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Rynchops niger	Black Skimmer			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Branchinecta mesovallensis	Midvalley Fairy Shrimp		Special	
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened

Hyalella spp.	Hyalella spp.			
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endangered	Endangered	Vulnerable - Moyle 2013
Spirinchus thaleichthys	Longfin smelt	Candidate	Threatened	Vulnerable - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
Anaxyrus boreas halophilus	California Toad			ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
INSECTS & OTHER INVERTS				
Hygrotus curvipes	Curved-foot Hygrotus Diving Beetle		Special	
Ablabesmyia spp.	Ablabesmyia spp.			
Apedilum spp.	Apedilum spp.			
Baetis tricaudatus	A Mayfly			
Chironomus spp.	Chironomus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			

Dicrotendipes spp.	Dicrotendipes spp.			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Hydroptila spp.	Hydroptila spp.			
Ischnura cervula	Pacific Forktail			
Libellula luctuosa	Widow Skimmer			
Oxyethira spp.	Oxyethira spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Procladius spp.	Procladius spp.			
Simulium spp.	Simulium spp.			
Sympetrum corruptum	Variegated Meadowhawk			
Tanytarsus spp.	Tanytarsus spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Fluminicola seminalis	Nugget Pebblesnail		Special	T
Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus spp.	Gyraulus spp.			
Helisoma spp.	Helisoma spp.			
Margaritifera falcata	Western Pearlshell		Special	
Physa spp.	Physa spp.			
Planorbella trivolvis	Marsh Rams-horn			CS
PLANTS				
Carex comosa	Bristly Sedge		Special	CRPR - 2B.1
Eryngium racemosum	Delta Coyote-thistle		Endangered	CRPR - 1B.1
Hibiscus lasiocarpos occidentalis			Special	CRPR - 1B.2
Lasthenia conjugens	Contra Costa Goldfields	Endangered	Special	CRPR - 1B.1
Lilaeopsis masonii	Mason's Lilaeopsis		Special	CRPR - 1B.1

Limosella australis	NA		Special	CRPR - 2B.1
Puccinellia simplex	Little Alkali Grass			
Symphyotrichum lentum	Suisun Marsh Aster		Special	CRPR - 1B.2
Alisma triviale	Northern Water-plantain			
Alnus rhombifolia	White Alder			
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla microphylla	Mexican mosquito fern		Special	CRPR - 4.3
Baccharis glutinosa	NA			Not on any status lists
Bidens laevis	Smooth Bur-marigold			
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Carex aquatilis dives	Sitka Sedge			
Carex nebrascensis	Nebraska Sedge			
Carex obnupta	Slough Sedge			
Carex vulpinoidea	NA			
Cephalanthus occidentalis	Common Buttonbush			
Ceratophyllum demersum	Common Hornwort			
Cicuta douglasii	Western Water-hemlock			
Cicuta maculata bolanderi	Bolander's Water-hemlock		Special	CRPR - 2B.1
Cirsium hydrophilum hydrophilum	Suisun Thistle	Endangered	Special	CRPR - 1B.1
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Crassula solieri	NA			Not on any status lists
Crypsis vaginiflora	NA			
Cyperus erythrorhizos	Red-root Flatsedge			

Downingia insignis	Parti-color Downingia			
Elatine californica	California Waterwort			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis parvula	Small Spikerush		Special	CRPR - 4.3
Elodea canadensis	Broad Waterweed			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eragrostis hypnoides	Teal Lovegrass			
Eryngium aristulatum aristulatum	California Eryngo			
Eryngium articulatum	Jointed Coyote-thistle			
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle		Special	CRPR - 1B.2
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Galium trifidum	Small Bedstraw			
Glyceria leptostachya	Slim-head Mannagrass			
Helenium bigelovii	Bigelow's Sneezeweed			
Helenium puberulum	Rosilla			
Hydrocotyle ranunculoides	Floating Marsh-pennywort			
Hydrocotyle umbellata	Many-flower Marsh-pennywort			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Isoetes howellii	NA			
Isoetes orcuttii	NA			
Isolepis cernua	Low Bulrush			
Juncus acuminatus	Sharp-fruit Rush			
Juncus articulatus articulatus				Not on any status lists
Juncus effusus effusus	NA			
Juncus effusus pacificus				
Juncus lescurii				Not on any status lists

Juncus phaeocephalus phaeocephalus	Brown-head Rush			
Lasthenia ferrisiae	Ferris' Goldfields		Special	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lemna minor	Lesser Duckweed			
Lemna minuta	Least Duckweed			
Lepidium oxycarpum	Sharp-pod Pepper-grass			
Limnanthes douglasii nivea	Douglas' Meadowfoam			
Limnanthes douglasii rosea	Douglas' Meadowfoam			
Limosella acaulis	Southern Mudwort			
Ludwigia peploides peploides	NA			Not on any status lists
Lycopus americanus	American Bugleweed			
Lythrum californicum	California Loosestrife			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Mimulus latidens	Broad-tooth Monkeyflower			
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Najas guadalupensis guadalupensis	Southern Naiad			
Navarretia cotulifolia	Cotula Navarretia			
Navarretia heterandra	Tehama Navarretia			
Oenanthe sarmentosa	Water-parsley			
Panicum acuminatum acuminatum				Not on any status lists
Paspalum distichum	Joint Paspalum			
Persicaria hydropiper	NA			Not on any status lists
Persicaria hydropiperoides				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists

Persicaria punctata	NA			Not on any status lists
Phacelia distans	NA			
Phalaris arundinacea	Reed Canarygrass			
Phragmites australis australis	Common Reed			
Pilularia americana	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pluchea odorata odorata	Scented Conyza			
Pogogyne zizyphoroides				Not on any status lists
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton illinoensis	Illinois Pondweed			
Potamogeton nodosus	Longleaf Pondweed			
Potamogeton zosteriformis	Flatstem Pondweed		Special	CRPR - 2B.2
Potentilla anserina pacifica				Not on any status lists
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rorippa palustris palustris	Bog Yellowcress			
Rumex crassus				Not on any status lists
Rumex occidentalis				Not on any status lists
Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Salix babylonica	NA			
Salix exigua exigua	Narrowleaf Willow			

Salix exigua hindsiana				Not on any status lists
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Samolus parviflorus	NA			Not on any status lists
Schoenoplectus acutus acutus	NA			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus americanus	Three-square Bulrush			
Schoenoplectus californicus	California Bulrush			
Senecio hydrophilus	Great Swamp Ragwort			
Sinapis alba	NA			
Sium suave	Hemlock Water-parsnip			
Sparganium eurycarpum eurycarpum				
Stachys albens	White-stem Hedge-nettle			
Triglochin maritima	Common Bog Arrow-grass			
Triglochin striata	Three-ribbed Arrow-grass			
Typha latifolia	Broadleaf Cattail			

Scientific Name	**Common Name**	**Legal Protected Status**		
		Federal	**State**	**Other**
BIRDS				
FISH				
HERPS				
INSECTS & OTHER INVERTS				

MAMMALS				
MOLLUSKS				
PLANTS				

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

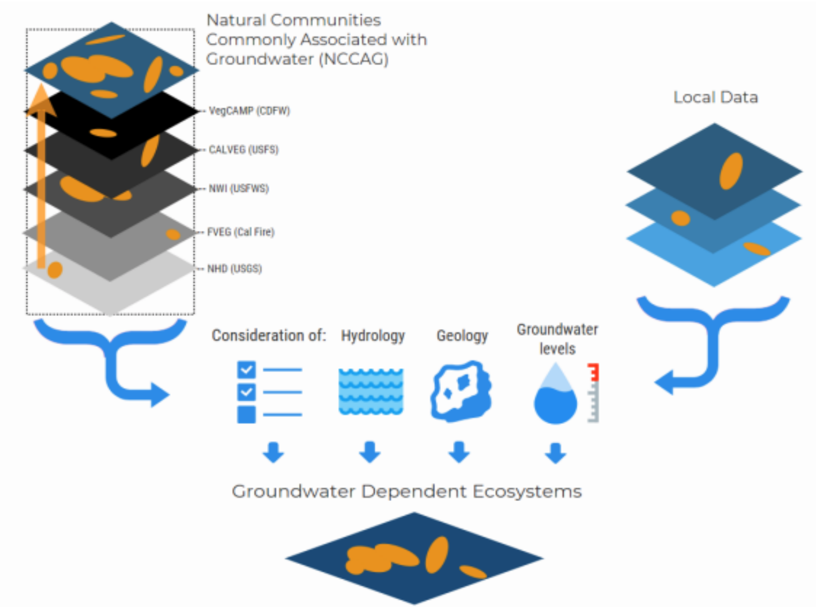


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

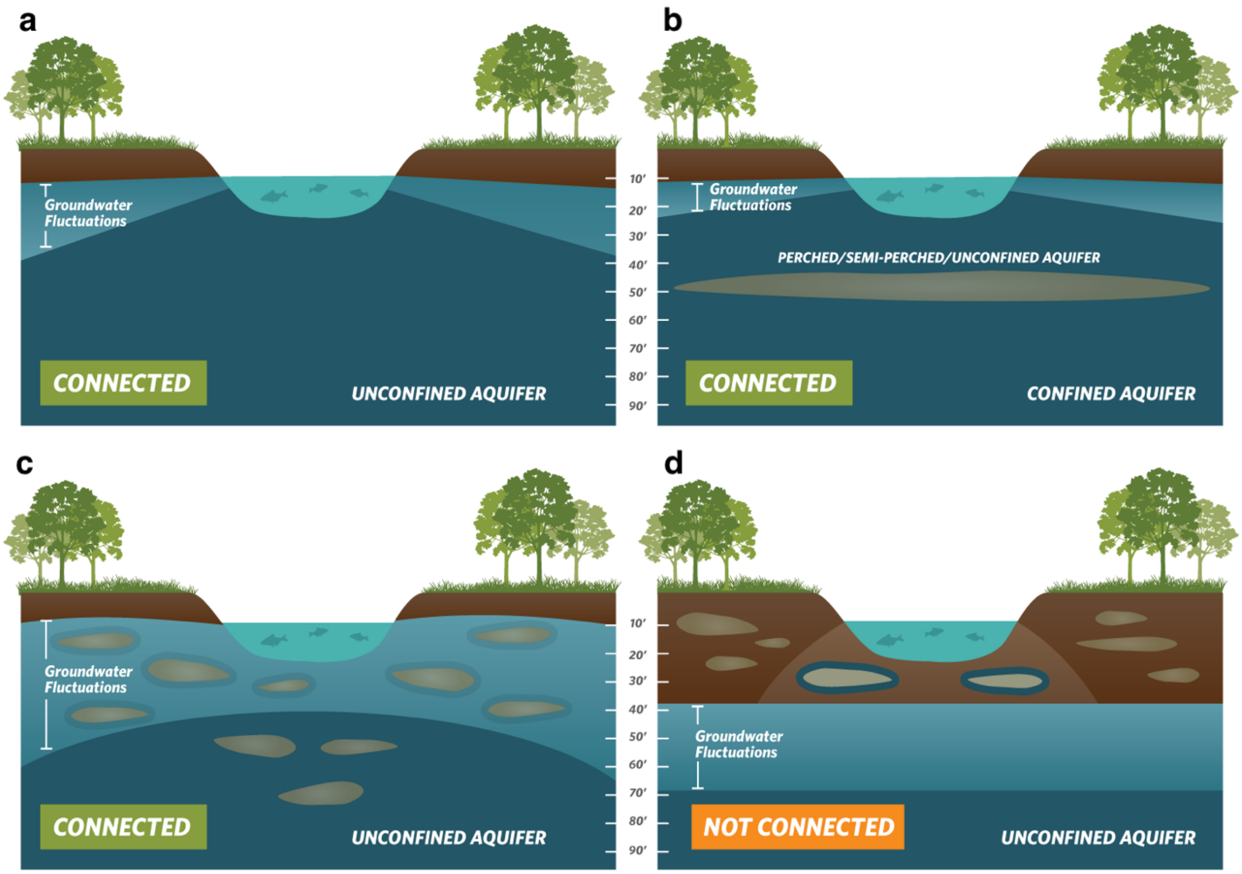

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

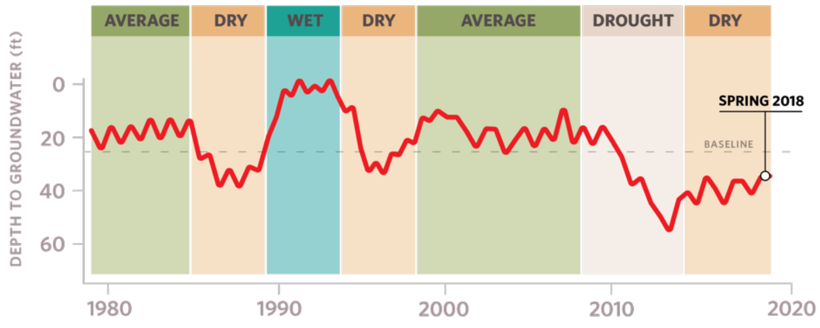

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

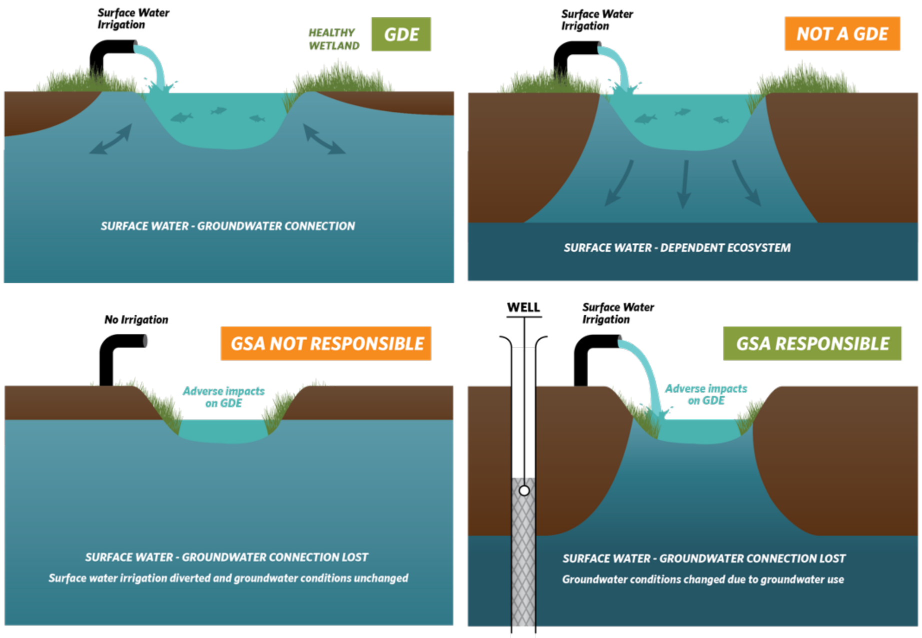

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

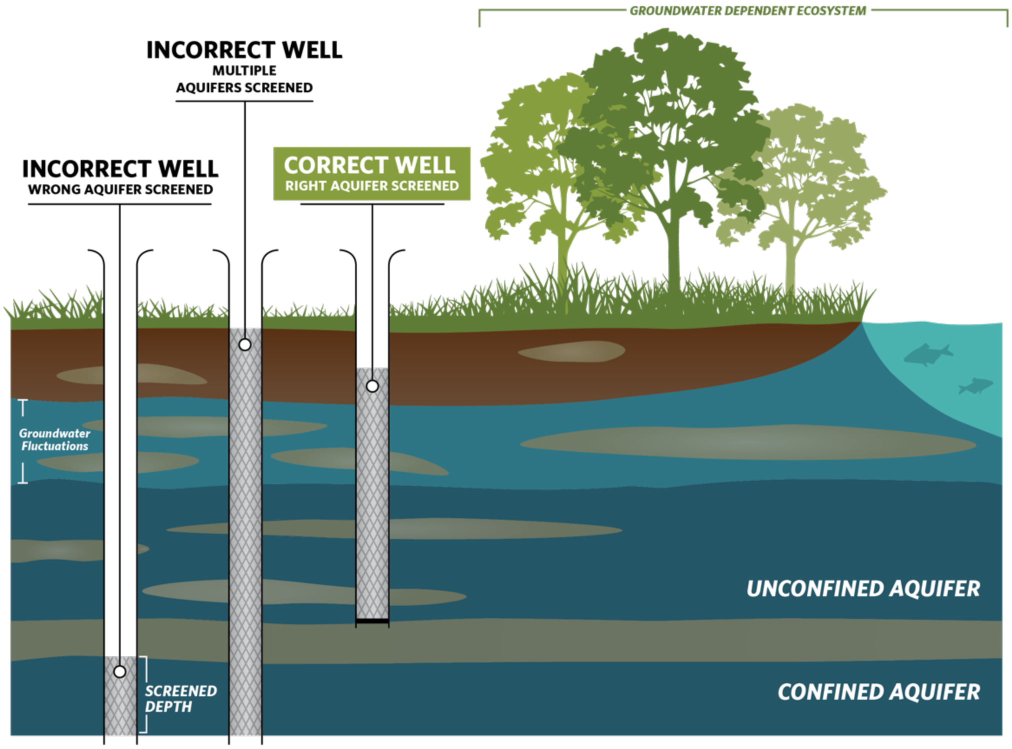

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

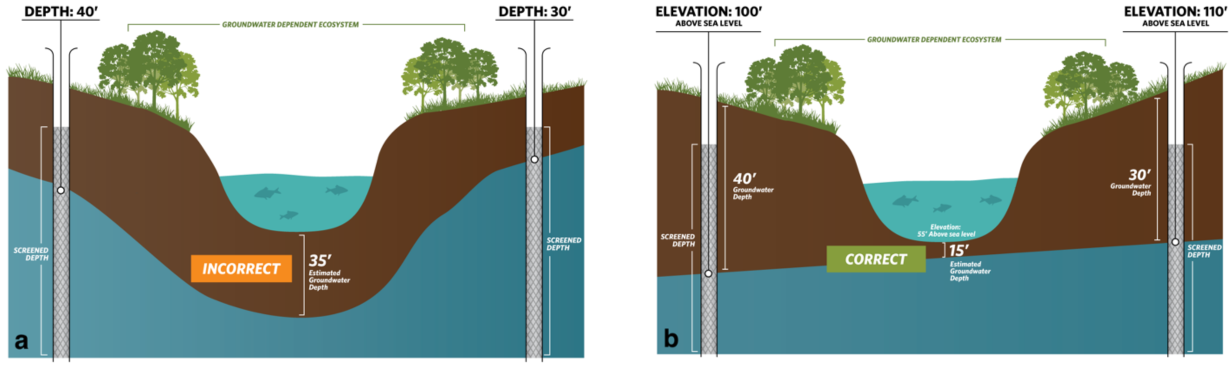

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

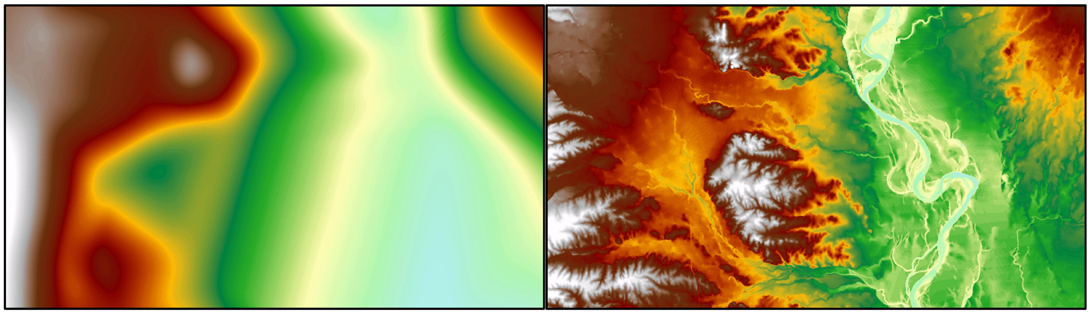

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

November 12, 2021

Tulelake Subbasin GSA
2717 Havlina Rd
Tulelake, CA 96134

Submitted via email: tulelakesgma@gmail.com

Re: Public Comment Letter for Tulelake Subbasin Draft GSP

Dear Kraig Beasly,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Tulelake Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Tulelake Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Tulelake Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. We note the following deficiencies with the identification of these key beneficial users.

- While the GSP implies that the whole subbasin qualifies as a DAC or SDAC, the GSP fails to identify, name and map each DAC or SDAC. It also fails to provide the population of each DAC within the subbasin.
- The GSP provides a density map of domestic wells in Figure 2-9, but fails to include the depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin. This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the basin.
- While Figure 2-4 identifies the water source types for the subbasin, the GSP fails to explicitly identify the populations dependent on groundwater as their source of drinking water. Specifics are not provided on how much each DAC community relies on a particular water supply (e.g., what percentage is supplied by groundwater).

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Describe and map the locations of DACs and provide the population of each DAC. The DWR DAC mapping tool can be used for this purpose.[2] Identify the sources of drinking water for DAC members, including an estimate of how many people rely on

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

[2] The DWR DAC mapping tool is available online at: https://gis.water.ca.gov/app/dacs/.

groundwater (e.g., domestic wells, state small water systems, and public water systems).

- Include a map showing domestic well locations and average well depth across the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP describes the use of a groundwater model (referred to as the GSA Model in Appendix K) to analyze the interaction between groundwater and surface water within the subbasin. While the Appendix gives a detailed description of the model, the GSP could be improved by including a summary in the main GSP text. This information should include groundwater level monitoring well data and stream gauge data that were incorporated into the model, the screening depths of wells used in the groundwater model, and description of the temporal (seasonal and interannual) variability of the data used to calibrate the model.

The GSP states (p. 2-58): *"The model was used to develop estimates of timing and volume of gains and losses."* However, it is not clear where this information is presented. No overall map of stream reaches showing interconnected reaches in the subbasin is presented in the main GSP text or the model appendix.

RECOMMENDATIONS

- Provide a map showing all the stream reaches in the subbasin, with reaches clearly labeled as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.
- Further describe the groundwater elevation data, including well screen depth interval, and stream flow data used in the GSA Model.
- To confirm and illustrate the results of the groundwater modeling, overlay the subbasin's stream reaches on depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis.
- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, we found that some mapped features in the NC dataset were improperly disregarded. NC dataset polygons were incorrectly removed in areas adjacent to irrigated fields or due to the presence of surface water supplies (including Tule Lake Sumps). However, this removal criteria is flawed since GDEs can rely on multiple water sources – including shallow groundwater receiving inputs from surface water supplies or irrigation return flow from nearby irrigated fields – simultaneously and at different temporal/spatial scales. NC dataset polygons adjacent to irrigated land or surface water supplies can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to irrigated fields or surface water supplies.

The GSP uses depth-to-groundwater data from Spring 2019 to characterize areas where the depth to groundwater was greater than 30 feet. We recommend using groundwater data from multiple seasons and water year types to determine the range of depth to groundwater around NC dataset polygons. Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying GDEs and is necessary to capture the variability in groundwater conditions inherent in California's Mediterranean climate.

Appendix H (Technical Memorandum – GDE Identification Data Processing Approach) presents a summary table of the vegetation and wetland classifications present in the NC Dataset. However, the GSP does not provide an inventory of the subbasin's fauna or acknowledge endangered, threatened, or special status species in the subbasin.

RECOMMENDATIONS

- Re-evaluate the NC dataset polygons that are adjacent to irrigated fields or surface water supplies. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.
- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types.
- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.
- Include an inventory of the fauna and flora present within the subbasin's GDEs (see Attachment C of this letter for a list of freshwater species located in the Tulelake Subbasin). Note any threatened or endangered species.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[3,4] The integration of these ecosystems into the water budget is **insufficient**. The water budget did not include the current, historical, and projected demands of native

[3] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[4] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

vegetation and managed wetlands. The GSP states that 12% of the subbasin is comprised of managed wetlands (p. 2-7). The omission of explicit water demands for native vegetation and managed wetlands is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

RECOMMENDATION
• Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation and managed wetlands.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Communication and Engagement Plan (Appendix C).[5]

For environmental stakeholders, the GSP notes inclusion of environmental stakeholder representation during the GSP development and implementation phases through the Tulelake Subbasin Core Advisory Team.

However, we note the following deficiencies with the overall stakeholder engagement process. Engagement opportunities listed for subbasin stakeholders are described in very general terms and include: emails sent to an established interested party email list, maintaining a list of interested stakeholder email database, website postings with agendas, meeting minutes, and presentations, and newspaper media.

The plan fails to provide information on outreach and engagement activities that are specifically targeted to DACs and domestic well owners. The GSP should be explicit in terms of how the GSA is *directly* engaging with stakeholders in a manner that recognizes the specific challenges and needs of DAC residents in the subbasin.

RECOMMENDATIONS
• In the Communication and Engagement Plan, describe active and targeted outreach to engage DACs and domestic well owners throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

[5] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the subbasin within the GSP.[6]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[7,8,9]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP states (p. 5-8): *"If the monitoring well is screened within the shallow aquifer and within three miles of a domestic well or wells, then the MT is defined as the minimum domestic well depth."* Table 5.1 (Groundwater Level Minimum Thresholds) provides the minimum thresholds and each well's historic low, represented at feet below ground surface. In all cases, the minimum threshold is deeper than the historic low groundwater depth, and for five of nine wells is at least twenty feet deeper than historic groundwater lows. The GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold, and whether the undesirable results are consistent with the Human Right to Water policy.[10] In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs or drinking water users when defining undesirable results, nor does it describe how the groundwater levels minimum thresholds are consistent with Human Right to Water policy and will avoid significant and unreasonable impacts on beneficial users.

For degraded water quality, SMC are established for nitrate and total dissolved solids (TDS). The GSP states (p. 5-9): *"The MTs for nitrate and TDS have been set equal to 10% less than the federal and/or state established goals. For nitrate, the MT is equal to 9.0 milligrams per liter (mg/L), which is less than the maximum contaminant level goal (MCLG) of 10 milligrams per liter (mg/L). This MT allows for continued use of groundwater as a drinking water supply without local public water suppliers needing to invest in systems for nitrate removal. For TDS, the MT is equal to 900 mg/L which is less than the State of California secondary drinking water standard upper limit of 1,000 mg/L. This MT is protective of the secondary standard for drinking water and water quality needed for irrigation purposes. These MTs are applied to all representative water quality monitoring wells."* Section 2.2.2.6 (Groundwater Quality) states that arsenic concentrations in groundwater have exceeded the MCL of 10 micrograms per liter in the Subbasin. The GSP has

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[6] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[7] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[8] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[9] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

[10] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

not established minimum thresholds for arsenic, however. SMC should be established for all COCs in the subbasin impacted or exacerbated by groundwater use and/or management.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and drinking water users when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs and drinking water users within the subbasin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be fully or partially de-watered at the minimum threshold.

Degraded Water Quality

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality.[11] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[12]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that are impacted or exacerbated by groundwater use and/or management.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC.

Sustainable management criteria for depletion of interconnected surface water are established by proxy using groundwater elevations. The undesirable result is set as follows: *"Groundwater elevations dropping below the Minimum Threshold criteria at this representative monitoring location* [DWR Monitoring Well No. 48N04E22M001M located adjacent to the Lost River] *over three consecutive spring measurements."* It should be noted that the minimum threshold at this well, as presented in Table 5-1 and set to the minimum domestic well depth, is set at 48 feet below ground surface, which is 19 feet *lower* than the historic groundwater low. No analysis or

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[11] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[12] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

discussion is presented to describe how the SMC will affect beneficial users, and more specifically GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin.[13] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[14]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[15] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,16]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently

[13] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[14] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[15] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[16] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

account for the range of potential climate futures.[17] The effects of climate change can intensify the impacts of water stress on GDEs, making available shallow groundwater resources more critical for their survival. Research shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[18] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP integrates climate change into key inputs (e.g., changes in precipitation and evapotranspiration) of the projected water budget. However, the plan fails to include surface water flow inputs for the projected water budget and incorporate the effects of climate change on these flows. The sustainable yield is calculated based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios and the omission of projected climate change effects on surface water flow inputs, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as DACs, ecosystems, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Include surface water flow inputs in the projected water budget and incorporate climate change effects on these flows.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Wells (RMWs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells,

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[17] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]
[18] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

GDEs, and ISWs in the subbasin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[19]

Figure 3-1 (Representative Groundwater Level Monitoring Network) shows insufficient representation of drinking water users and DACs for groundwater elevation monitoring. Figure 3-2 (Groundwater Quality Monitoring Network) shows insufficient representation of drinking water users and DACs for water quality monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater.

The GSP provides some discussion of data gaps for GDEs and ISWs in Section 6.1.4 (Projects and Management Actions - Groundwater Dependent Ecosystems), but does not provide specific plans, such as locations or a timeline, to fill the data gaps.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, GDEs, and ISWs to clearly identify monitored areas.
- Increase the number of RMWs in the shallow aquifer across the subbasin as needed to adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMWs.
- Ensure groundwater elevation and water quality RMWs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient** due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

While Section 6.1.5 documents the GSA's interest in groundwater recharge projects, the GSP fails to provide details or describe these projects' explicit benefits or impacts to beneficial users, including the environment and DACs. The GSP includes a domestic well assistance program. However, the program is described as a potential project to be implemented on an as-needed basis instead of a proposed project that will be implemented within the GSP planning horizon. We strongly recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation.

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[19] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

RECOMMENDATIONS

- For DACs and domestic well owners, provide specific plans for implementation of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSAs plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[20]

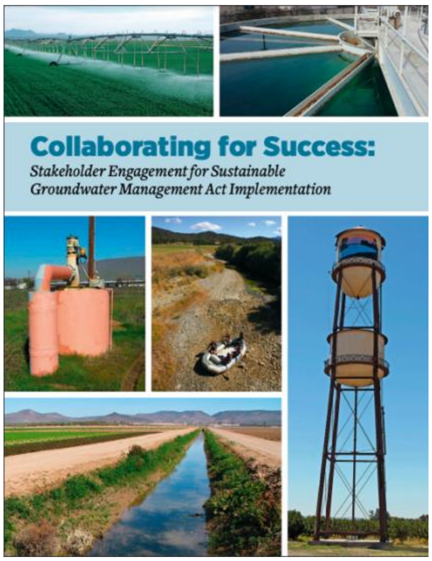
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[20] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



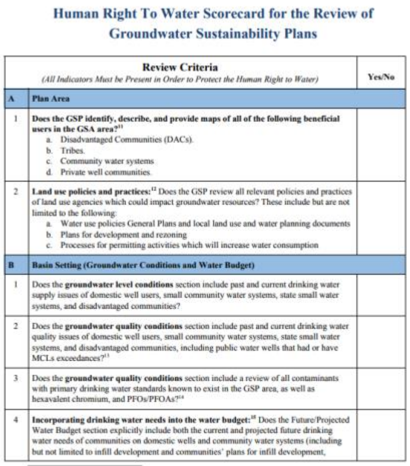
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

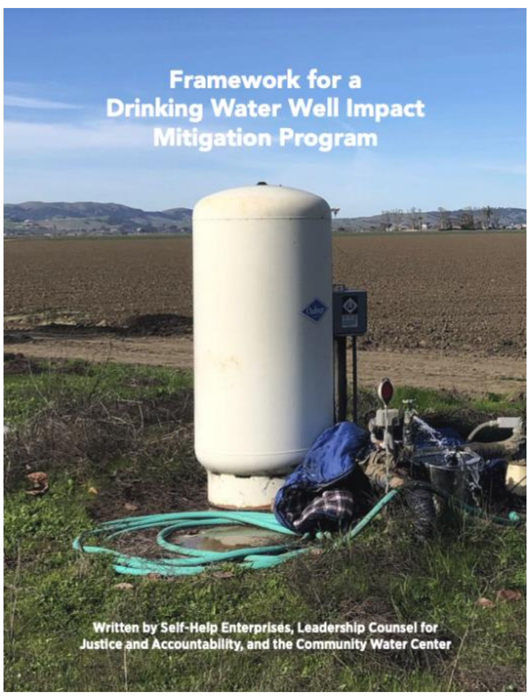


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

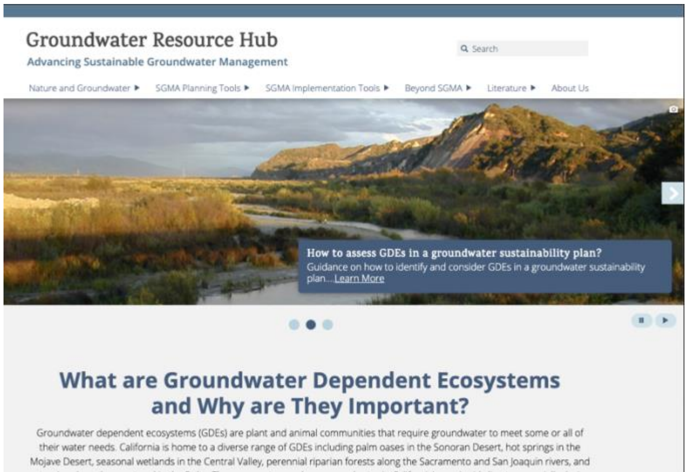
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



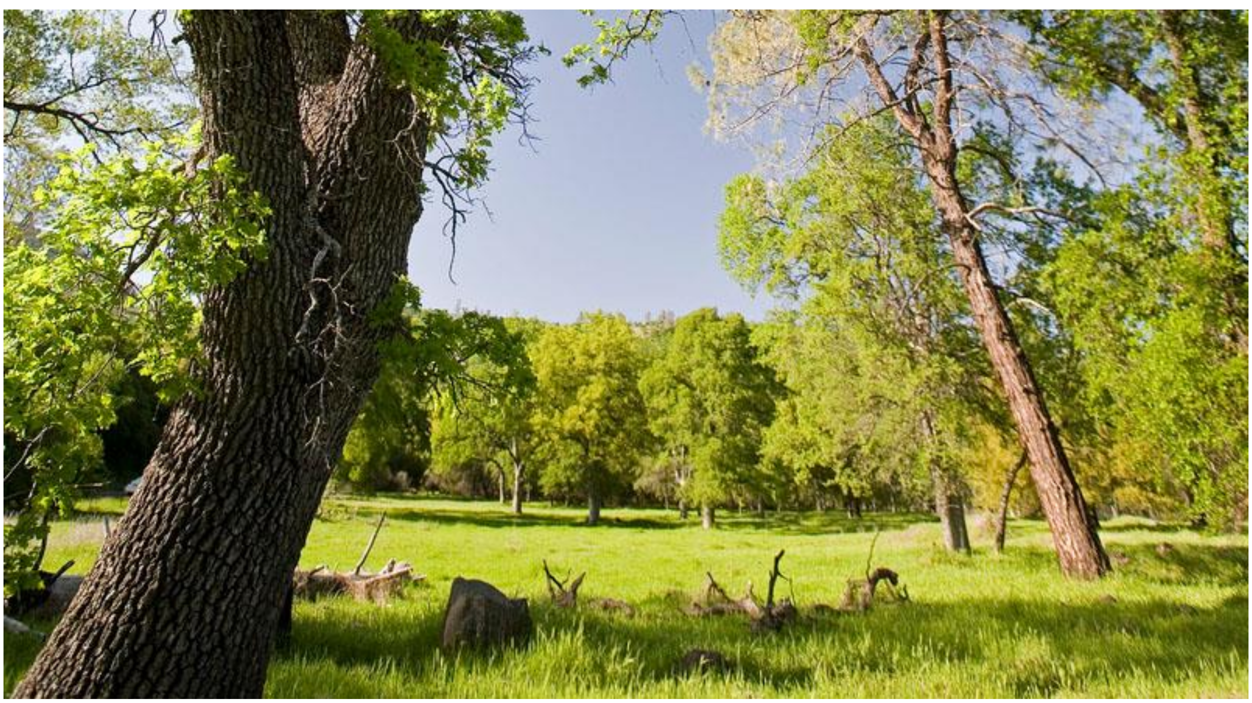
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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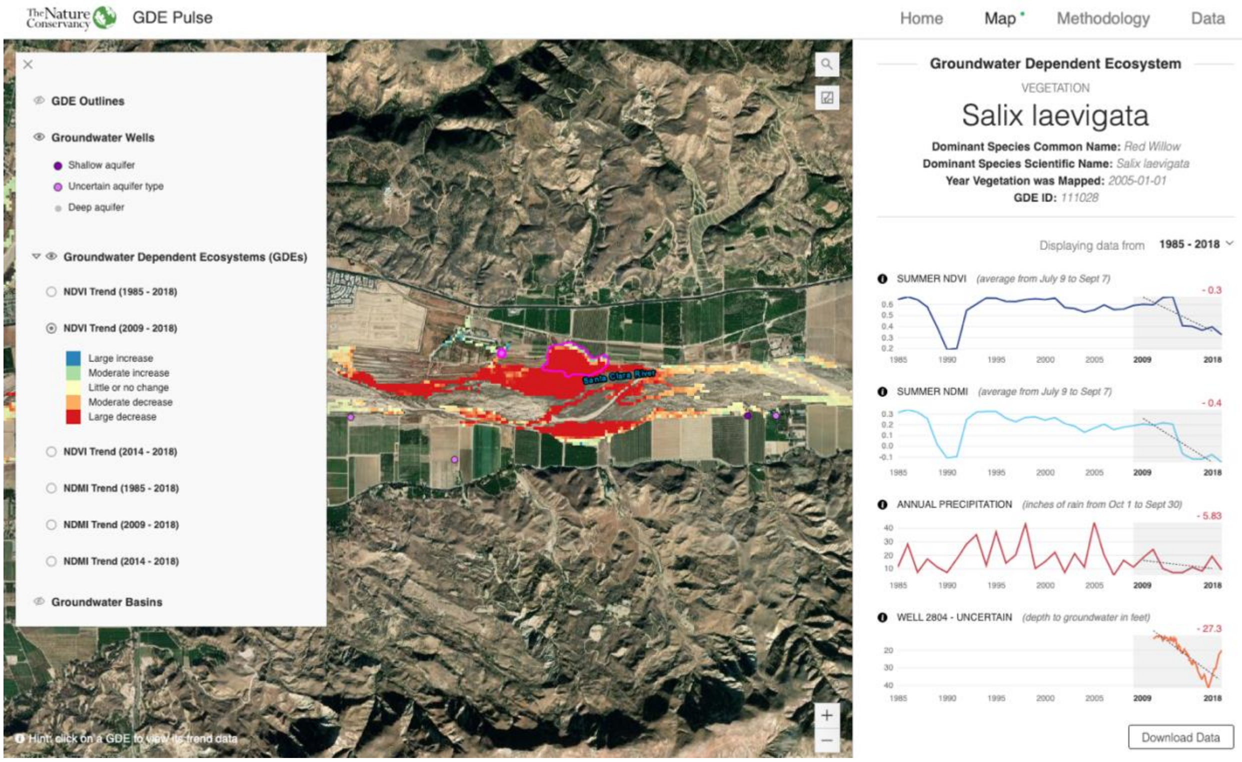
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

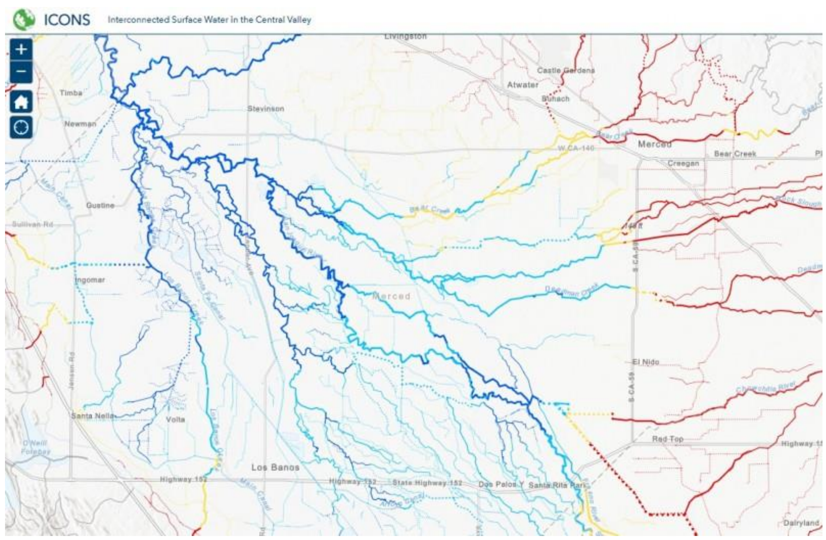
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Tulelake Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Tulelake Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	**State**	**Other**
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			

Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
FISH				
Chasmistes brevirostris	Shortnose sucker	Endangered	Endangered	Endangered - Moyle 2013
Gila coerulea	Blue chub		Special Concern	Near-Threatened - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Lithobates pipiens	Northern Leopard Frog		Special Concern	ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
Rana pretiosa	Oregon Spotted Frog	Proposed Threatened	Special Concern	ARSSC

Spea intermontana	Great Basin Spadefoot			ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Sympetrum corruptum	Variegated Meadowhawk			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
Sorex palustris	American Water Shrew			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
PLANTS				
Potentilla newberryi	Newberry's Cinquefoil		Special	CRPR - 2B.3
Rorippa columbiae	Columbia Yellowcress		Special	CRPR - 1B.2
Alopecurus pratensis	NA			
Lemna turionifera	Turion Duckweed			
Persicaria lapathifolia				Not on any status lists
Potamogeton richardsonii	Richardson's Pondweed			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Stuckenia pectinata				Not on any status lists
Symphyotrichum frondosum	Alkali Aster			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

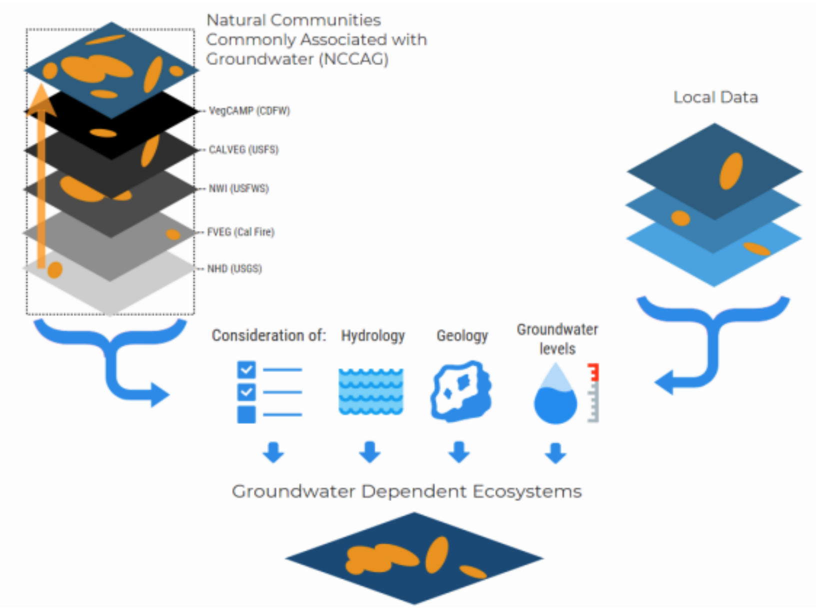


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

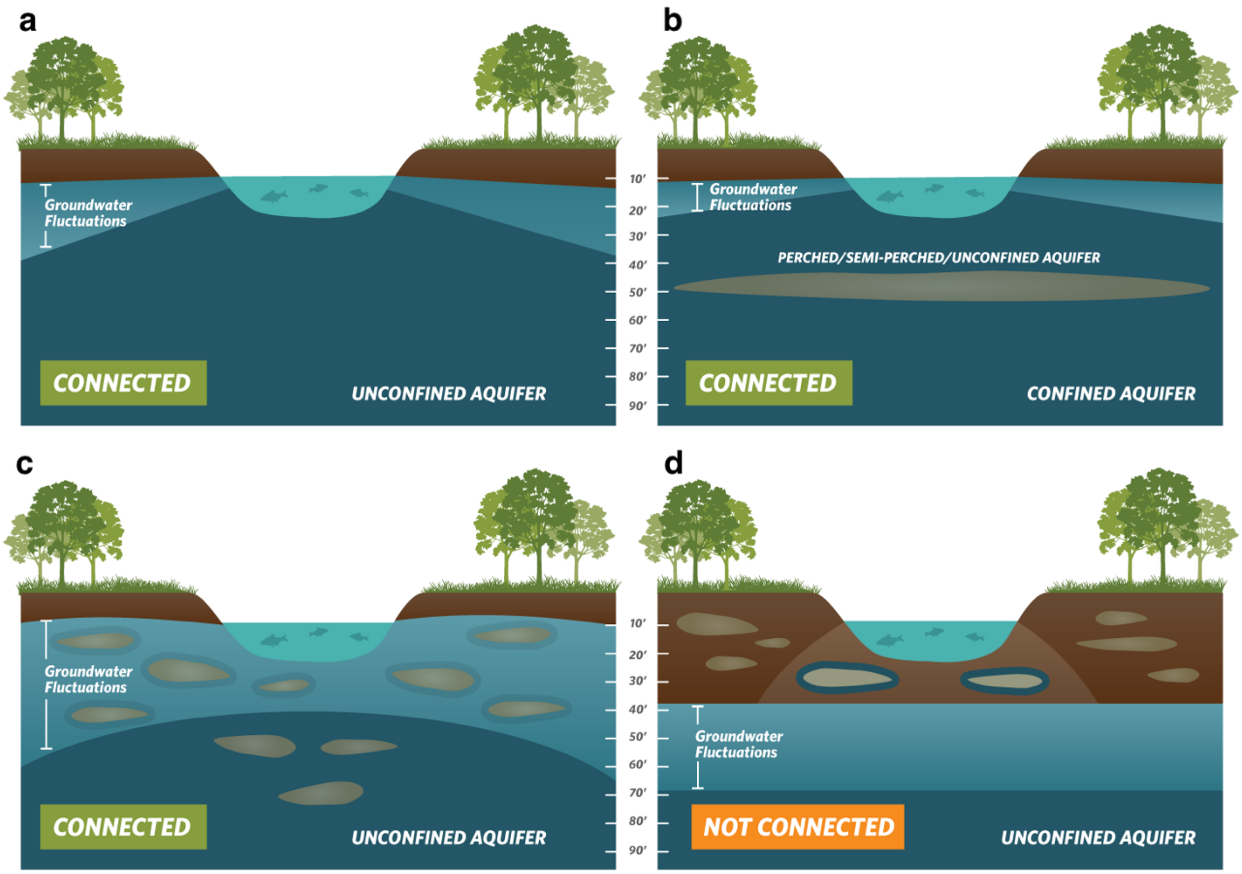

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

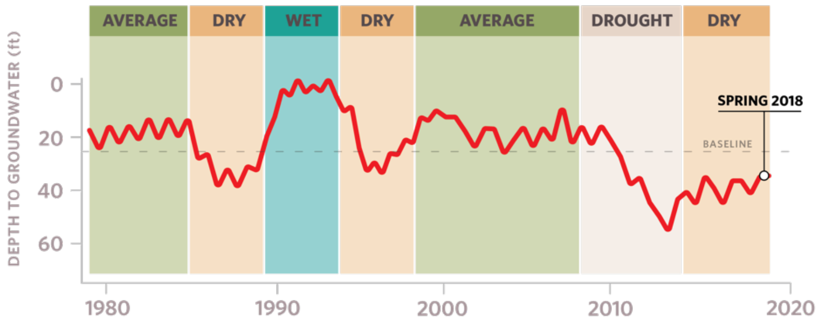

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

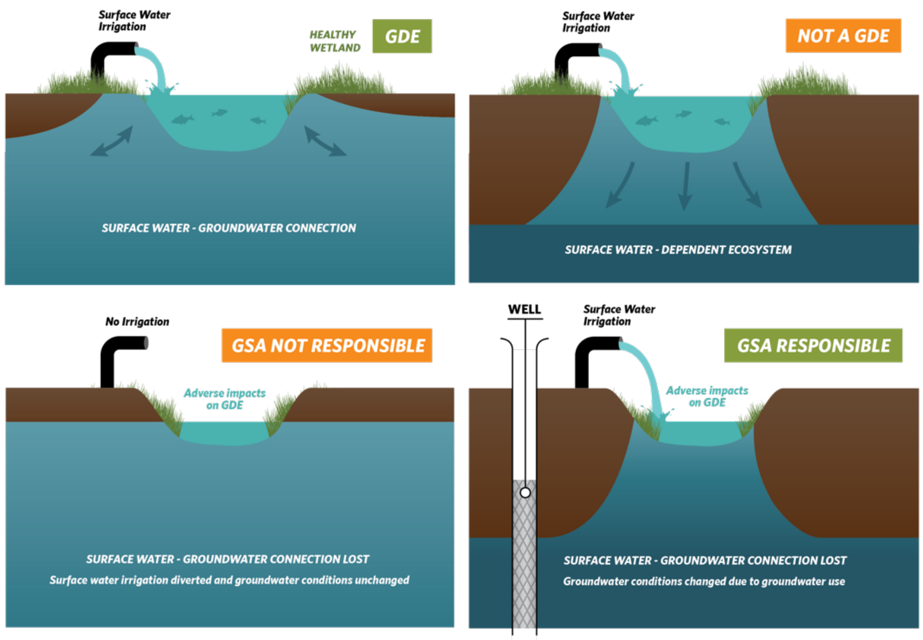

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

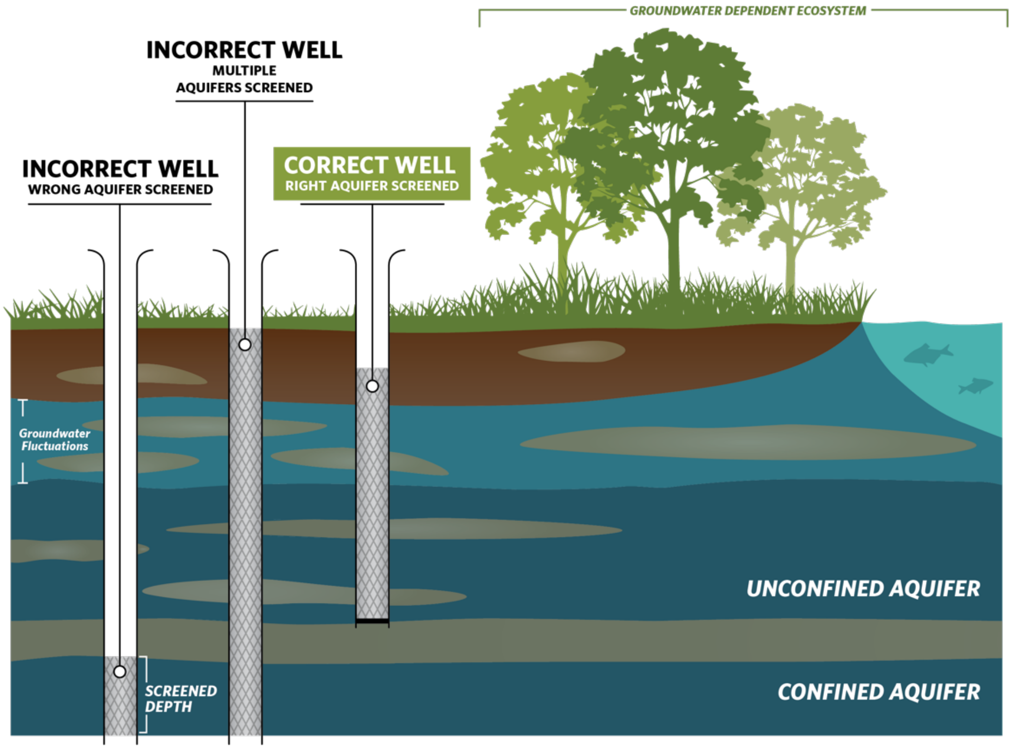

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

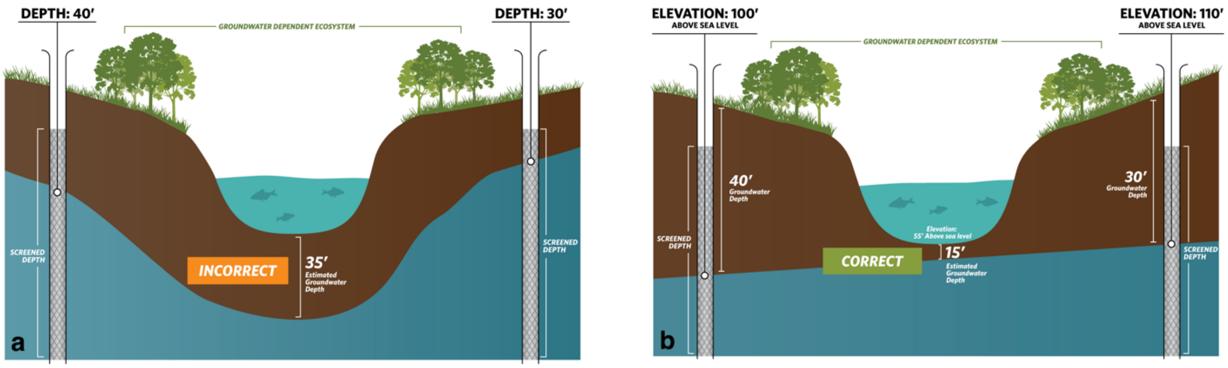

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

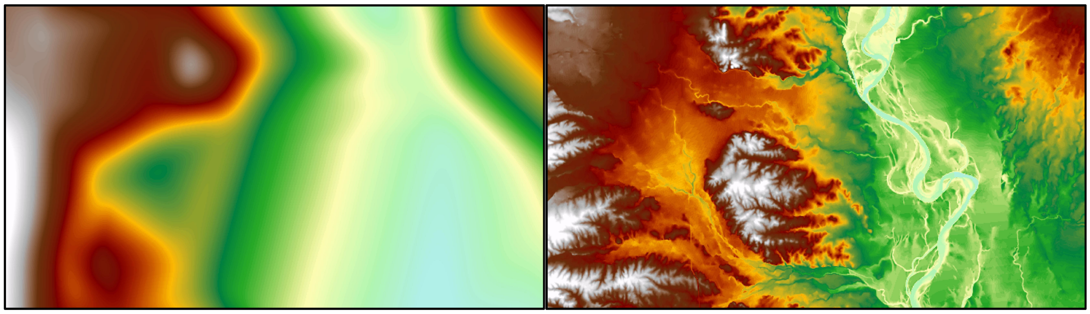

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

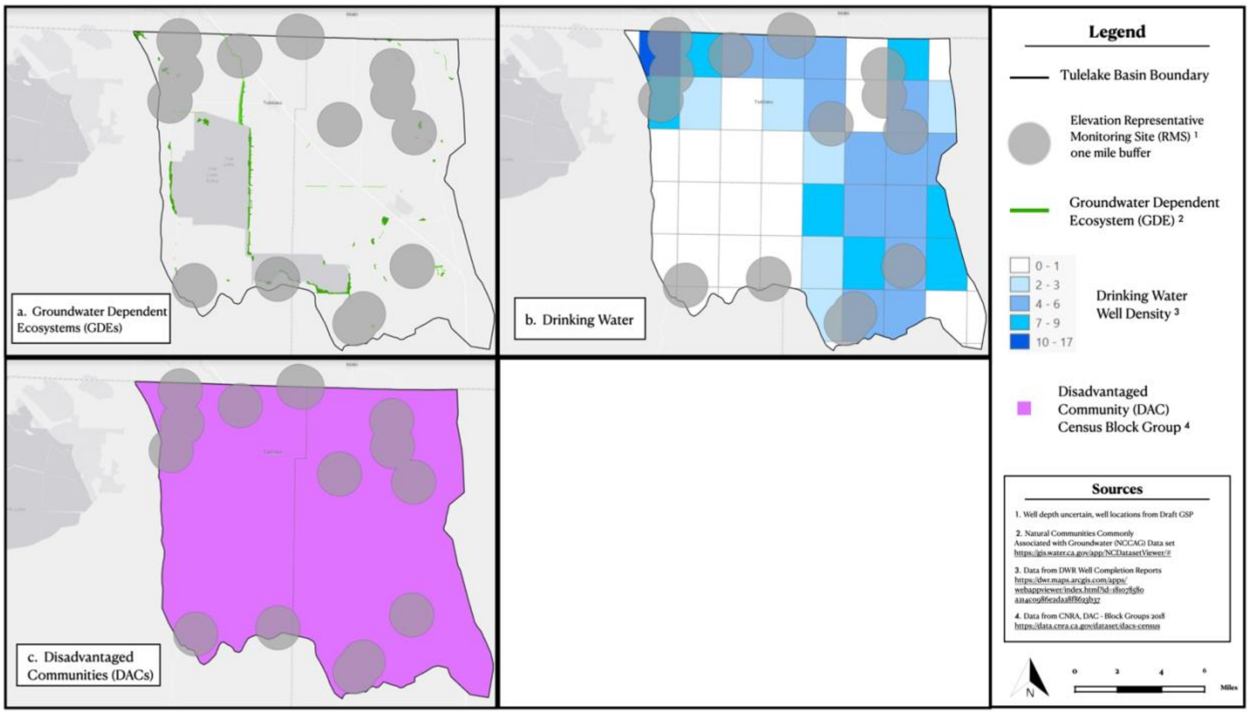

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

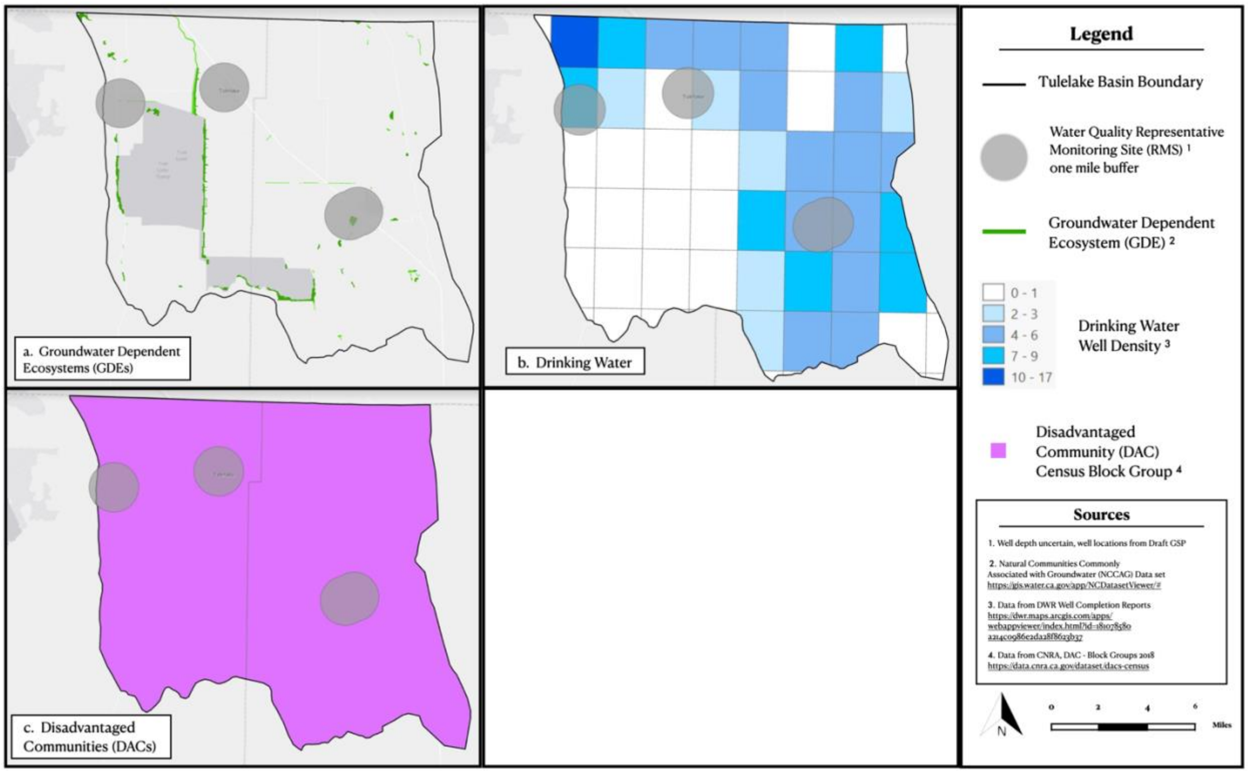

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

December 15, 2021

East Turlock Subbasin GSA and West Turlock Subbasin GSA
PO Box 949
Turlock, CA 95381-0949

Submitted via email: turlockgroundwater@gmail.com

Re: Public Comment Letter for Turlock Subbasin Draft GSP

Dear Kevin Kauffman,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Turlock Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Turlock Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Turlock Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **sufficient**. The GSP provides information on DACs, including identification by name, location on a map (Figure 3-1), and description of the size of each DAC population. The GSP also identifies specific water sources for DACs, severely disadvantaged communities (SDACs), and economically distressed areas, including the population dependent on groundwater.

The GSP provides the necessary information on domestic wells to understand the distribution of shallow and vulnerable drinking water wells within the subbasin. The GSP provides a density map of domestic wells (Figure 2-11), as well as a separate map of domestic wells color coded by depth (Figure 2-13).

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP describes the use of a groundwater model, the C2VSim-TM model, to analyze the interaction between groundwater and surface water within the subbasin. The model is briefly described in the Water Budget section of the GSP which refers to model documentation included in Appendix X, but this appendix was not provided as part of the draft GSP. The GSP could be improved by including a summary of the model in the main GSP text, including groundwater level monitoring well data and stream gauge data that were incorporated into the model, the screening depths of wells used in the groundwater model, and description of the temporal (seasonal and interannual) variability of the data used to calibrate the model.

The GSP provides general statements regarding the connected nature of reaches. The GSP states (p. 4-48): *"In the Turlock Subbasin, each of the three Subbasin river boundaries have been characterized as interconnected surface water (Phillips, et al., 2015; Durbin, 2003). Given the varying conditions of the river stage and groundwater levels – both seasonally and over time – groundwater-surface water interaction is dynamic and can alternate between losing and gaining conditions along various river reaches."* However, the GSP does not provide a map of these

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

reaches to illustrate the conclusions of the modeling analysis regarding which reaches are connected to groundwater.

RECOMMENDATIONS
• Provide a map showing all the stream reaches in the subbasin, with reaches clearly labeled as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP. • In the main text of the GSP, summarize the groundwater elevation data and stream flow data used in the modeling analysis. Discuss temporal (seasonal and interannual) variability of the data used to calibrate the model. • To confirm and illustrate the results of the groundwater modeling, overlay the subbasin's stream reaches with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis. • For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, we found that some mapped features in the NC dataset were improperly disregarded. NC dataset polygons were incorrectly removed if Normalized Difference Vegetation Index (NDVI) and Normalized Difference Moisture Index (NDMI) data did not correlate with groundwater level trends. This is an incorrect method, since a lack of a relationship does not preclude that groundwater is providing some of the ecosystem's water needs. If the ecosystem is accessing groundwater, then the ecosystem should be categorized as a GDE. If there are no data to characterize groundwater conditions underlying the GDE, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP.

The GSP uses depth-to-groundwater data from a wet year (1998) and a critically dry year (2015) to characterize areas where the depth to groundwater was less than 30 feet. While we recognize that use of data from wet and dry periods is appropriate, we recommend using more recent groundwater data, where available, over multiple seasons and water year types to determine the range of depth-to-groundwater underlying NC dataset polygons. We also recommend showing the location of wells used in the analysis on both the GDE map (Figure 4-64. Potential Vegetation and Wetland GDEs) and depth-to-groundwater map (Figure 4-63. Areas with Depth to Water within 30 feet in 1998) so that proximity of groundwater data to GDEs can be readily determined.

The GSP does not provide an inventory of flora and fauna in the subbasin, nor is any discussion of threatened or endangered species provided.

RECOMMENDATIONS

- Re-evaluate the NC dataset polygons that were incorrectly removed based on NDVI and NDMI trends. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.
- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Show the location of wells used in the analysis on the GDE map and depth-to-groundwater contour map.
- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as Valley Oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether Valley Oak polygons from the NC Dataset are connected to groundwater. It is important to emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and proximity to other water sources.
- Discuss data gaps for GDEs. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.
- Provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin and note any threatened or endangered species (see Attachment C in this letter for a list of freshwater species located in the Turlock Subbasin).

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of native vegetation into the water budget is **sufficient**. We commend the GSA for including the groundwater demands of this ecosystem in the historical, current and projected water budgets. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the subbasin.

[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

RECOMMENDATION
• State whether or not there are managed wetlands in the subbasin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development
Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Notice and Communication section (Chapter 3) of the GSP.[4]

Chapter 3 of the Draft GSP appears to be under development at the time of publication, due to highlighted sections and missing appendices (including Appendix 3-1: Turlock Subbasin Communications Plan). Ensure that as this section is finalized, it addresses the following deficiencies with the overall stakeholder engagement process as currently presented in the GSP:

- The GSP documents opportunities for public involvement and engagement in very general terms for listed stakeholders. Public notice and engagement activities include public meetings, GSA meetings made available on YouTube, Technical Advisory Committee meetings, GSP technical and community workshops, adjacent subbasin coordination meetings, email notifications to an interested parties list, updates to the GSA website, sharing information over social media and flyers, and outreach to local media. The GSP does not state whether there was direct engagement with DACs and environmental stakeholders or representatives, or whether these stakeholders are represented on the Technical Advisory Committee.

- The plan does not include documentation on how stakeholder input from the above-mentioned outreach and engagement was solicited, considered, and incorporated into the GSP development process.

- The GSP states (p. 3-22): *"GSAs will inform the public on Plan implementation utilizing the same successful engagement strategies described in the sections above, including email notifications to Interested Parties List, posting information on the Turlock Groundwater website, sharing information via social media channels, distributing flyers where appropriate, outreach to local media, and hosting public meetings (e.g. GSA meetings, TAC meetings, meetings of GSA member agencies and workshops)."* However, the GSP does not include a detailed plan for continual opportunities for engagement through the implementation phase of the GSP that is specifically directed to DACs, domestic well owners, and environmental stakeholders within the subbasin.

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

RECOMMENDATIONS

- Include the missing Chapter 3 appendices in the Final GSP.
- Describe active and targeted outreach to engage DACs, drinking water users, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.
- Clearly identify which stakeholders the members of the Technical Advisory Committee represent (e.g., DACs, environmental) and how their input was incorporated into the GSP.
- Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the subbasin.[5]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP provides discussion of the impact on water supply wells, including domestic wells, from the recent drought. Minimum thresholds are set to the low groundwater elevation observed in Fall 2015 at each representative monitoring site in each principal aquifer. The GSP justifies this in part with the following statement (p. 6-15): *"The large number of deeper domestic wells drilled since 2015 can be reasonably assumed to accommodate 2015 water levels, with some tolerance for future droughts."* However, despite the discussion of impacts to domestic wells during the previous drought, no quantitative data is provided on the impact to current domestic wells, including those that may not have been recently replaced. The GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs or drinking water users when defining undesirable results, nor does it describe how the groundwater level minimum

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[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

thresholds are consistent with the Human Right to Water policy and will avoid significant and unreasonable impacts on these beneficial users.[9]

The GSP establishes an undesirable result to be when at least 33% of representative monitoring wells exceed the minimum threshold for a principal aquifer in three consecutive fall semi-annual monitoring events. Using this definition of undesirable results for groundwater levels, significant and unreasonable impacts to beneficial users experienced during dry years or periods of drought will not result in an undesirable result. This is problematic since the GSP is failing to manage the subbasin in such a way that strives to minimize significant adverse impacts to beneficial users, which are often felt greatest in below-average, dry, and drought years. Furthermore, the requirement that one-third of monitoring wells exceed the minimum threshold before triggering an undesirable result means that areas with high concentrations of domestic wells may experience impacts significantly greater than the established minimum threshold because the one-third threshold isn't triggered.

For degraded water quality, minimum thresholds are set as the primary or secondary California maximum contaminant level (MCL) for water quality constituents of concern (COCs), which include both anthropogenic and naturally-occurring COCs. The GSP establishes measurable objectives as follows (p. 6-45): *"Measurable objectives are defined as no increase above the maximum historical concentration for any constituent of concern in a potable water supply well in the GSP monitoring program caused by GSA management activities."* The GSP establishes undesirable results as follows (p. 6-35): *"The undesirable result will occur if a new (first-time) exceedance of an MT is observed in a potable water supply well in the representative monitoring network that results in a well owners increase on operational costs and is caused by GSA management activities as listed above."*

The minimum thresholds for degraded water quality for each of the identified key water quality constituents are based on their MCLs. According to the state's anti-degradation policy,[10] high water quality should be protected and is only allowed to worsen to the MCL if a finding is made that it is in the best interest of the people of the State of California. No analysis has been done and no such finding has been made.

The GSP only includes a very general discussion of impacts on drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds for degraded water quality. The GSP does not, however, mention or discuss direct and indirect impacts on DACs when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

RECOMMENDATIONS
Chronic Lowering of Groundwater Levels ● Describe direct and indirect impacts on drinking water users and DACs when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels. Include information on the impacts during prolonged periods of below average water years.

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

[10] Anti-degradation Policy https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users and DACs within the subbasin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be fully or partially de-watered at the minimum threshold.

- Consider minimum threshold exceedances during single dry years when defining the groundwater level undesirable result across the subbasin.

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users and DACs when defining undesirable results for degraded water quality.[11] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[12]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users and DACs.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC for chronic lowering of groundwater levels. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. The GSP justifies the consideration of impacts to GDEs for only the depletion of interconnected surface water sustainability indicator by stating that GDEs are primarily located near surface water features. However, Figure 4-62 (Vegetation Commonly Associated with Groundwater and Wetlands) shows GDEs in areas of the subbasin that are non-adjacent to surface water.

Sustainable management criteria for depletion of interconnected surface water are established by proxy using groundwater levels. For the Tuolumne and San Joaquin Rivers, the minimum threshold is the low groundwater elevation observed in Fall 2015 at each representative monitoring site. For the Merced River, the minimum threshold is the groundwater elevation observed in Spring 2014 at each representative monitoring site. The GSP notes that the minimum thresholds along the Merced River are set at the slightly higher Spring 2014 groundwater elevations to maintain interconnectedness along the river and reduce the potential for future streamflow depletion. Undesirable results are established as follows (p. 6-62): *"An undesirable result will occur on one of the three monitored rivers when 50% of the representative monitoring sites for that river exceed the MT in two consecutive Fall monitoring events."* However, if minimum thresholds are set to drought-level low groundwater levels (for the Tuolumne and San Joaquin Rivers) and the subbasin is allowed to operate at or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than

[11] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]
[12] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse. No analysis or discussion is presented to describe how the SMC will affect beneficial users, and more specifically GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin.[13] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[14]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[15] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[8,16]

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[13] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[14] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[15] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[16] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[17] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[18] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2070. However, the GSP does not indicate whether multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) were considered in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring and their consideration is not required (only suggested) by DWR, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP integrates climate change into key inputs (e.g., changes in precipitation, evapotranspiration, and surface water flow) of the projected water budget. However, the sustainable yield is based on the projected baseline water budget, instead of the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios and the omission of climate change projections in the sustainable yield calculations, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

[17] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]
[18] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent shallow groundwater elevations around DACs and domestic wells in the subbasin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. While we note that the plan states (p. 7-11): *"Data gaps in the monitoring network will be addressed with a Management Action to improve future GSP monitoring,"* this Management Action was not included in the Draft GSP. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[19]

Figure 7-4 (Water Quality Monitoring Sites) shows sufficient representation of DACs and drinking water users for the water quality monitoring network. Maps of shallow and deep wells within the subbasin (Figures 7-1 to 7-3) show insufficient spatial representation of DACs and drinking water users for the groundwater elevations monitoring network, particularly in areas with the highest density of drinking water wells. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater. Note that we were only able to map groundwater elevation RMSs with information provided in the Draft GSP.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify monitored areas.
- Increase the number of RMSs in the shallow aquifer across the subbasin as needed to map ISWs and adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMSs.
- Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.
- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **incomplete**. The GSP identifies benefits and impacts of identified projects and management actions to beneficial users of groundwater. However, while the GSP describes multiple recharge projects (e.g., Dianne Storm Basin, Stanislaus State Stormwater Recharge, and the Mustang Creek Flood Control Project), it fails to describe the explicit environmental benefits for these or other projects and management actions within the subbasin. Therefore, potential project and management actions may not protect environmental beneficial

[19] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

We note that the GSP includes a domestic well mitigation program (Section 8.4.3) to monitor and protect drinking water wells. We recommend that the GSP provide an explicit timeline for planned implementation of the domestic well mitigation program.

RECOMMENDATIONS

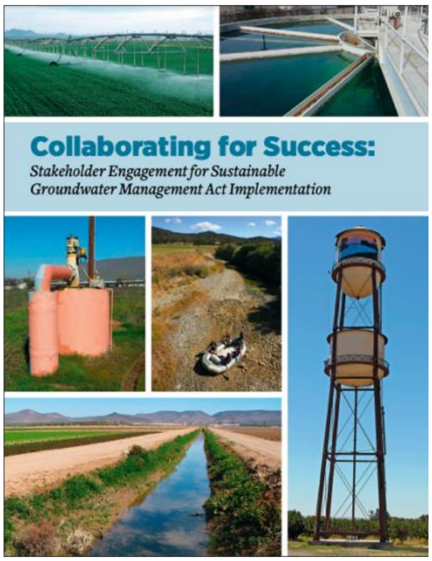
- Describe the projected timeline for implementation of the domestic well mitigation program in Chapter 8 of the GSP.
- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[20]
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[20] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

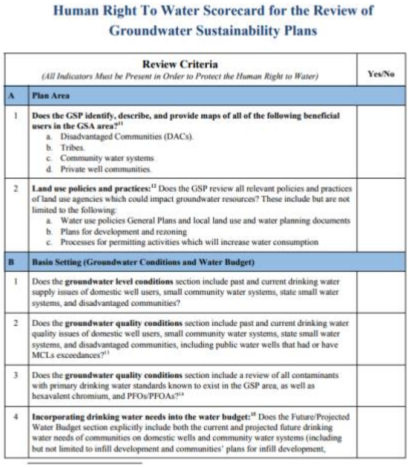
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

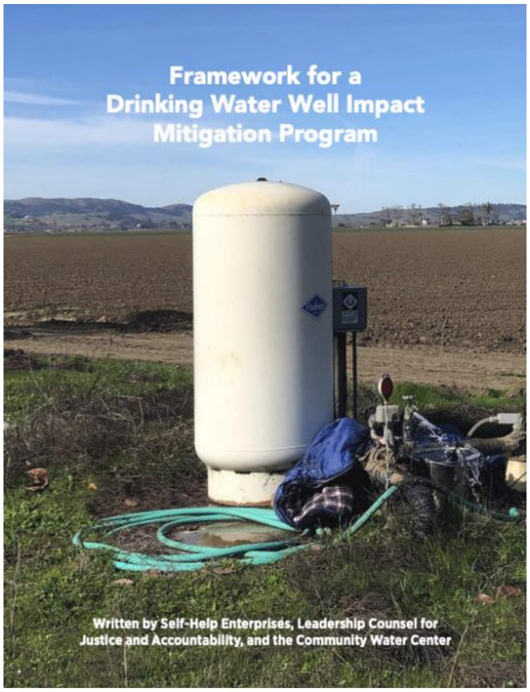
The Human Right to Water


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

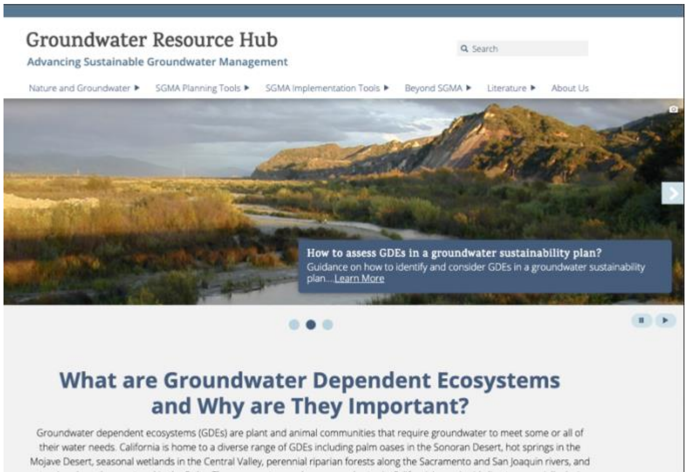
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



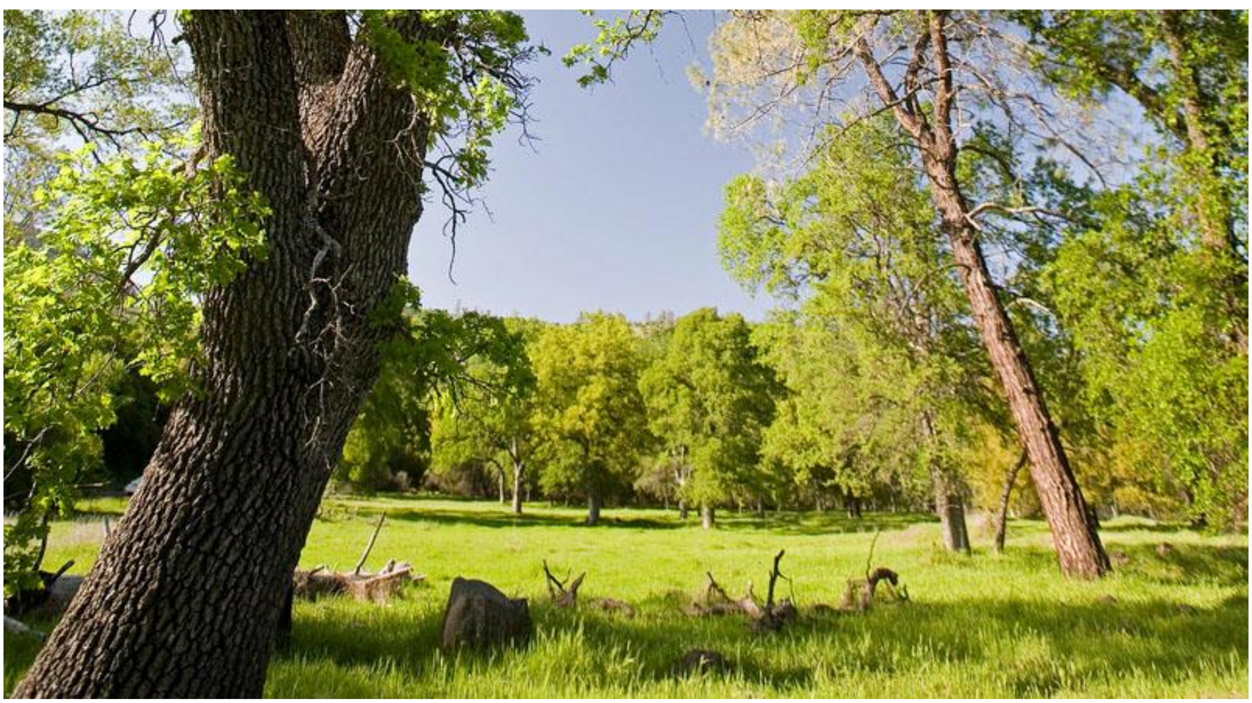
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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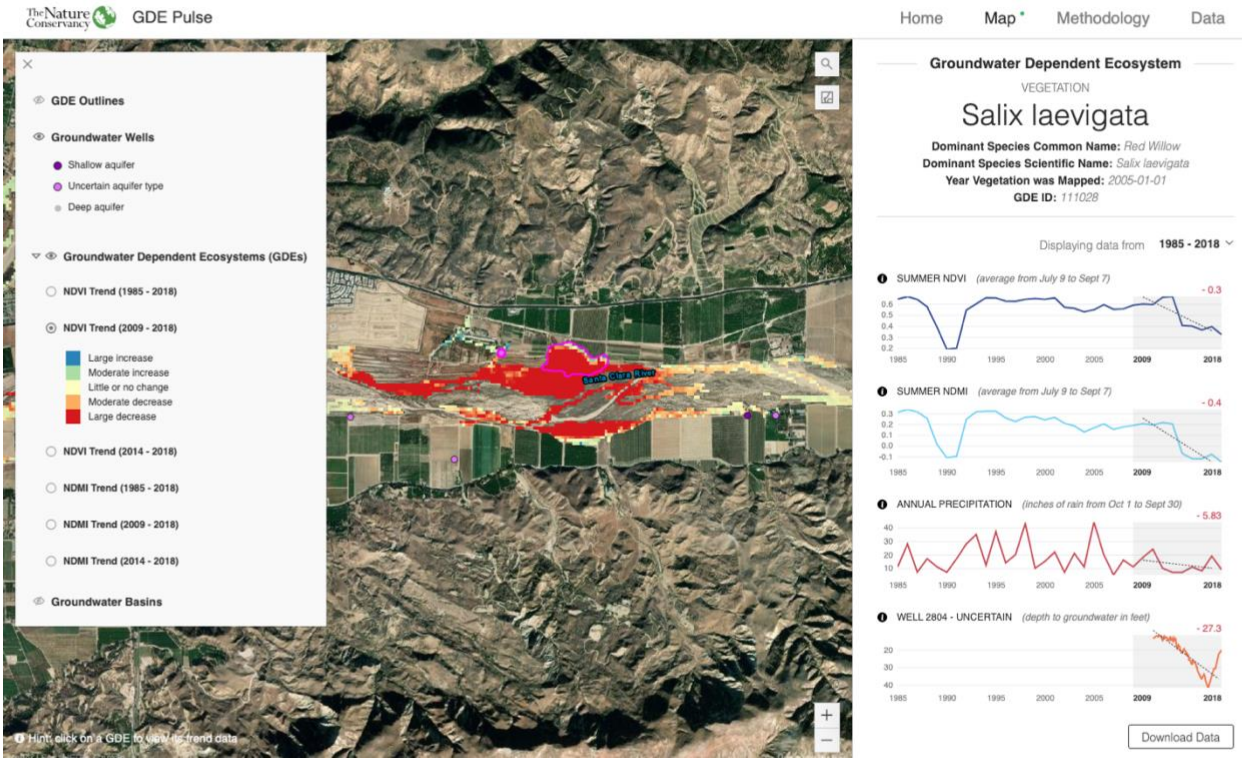
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

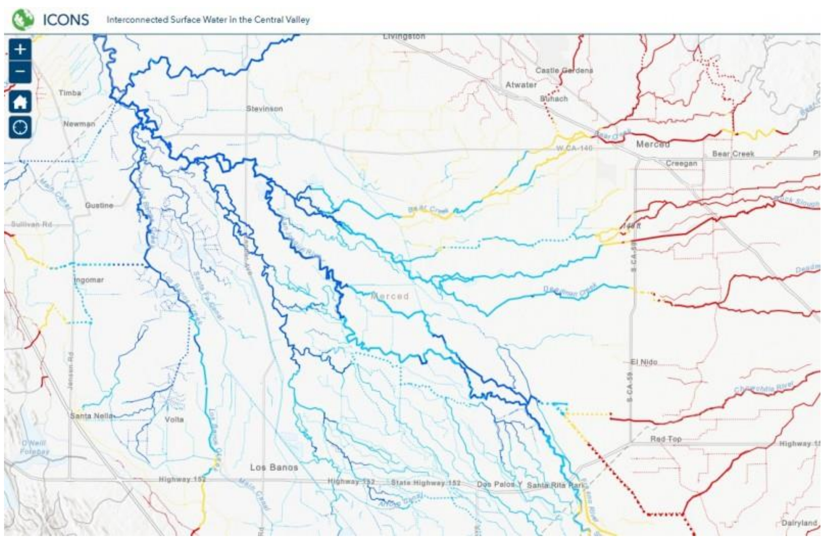
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Turlock Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Turlock Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pandion haliaetus	Osprey		Watch list	

Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta conservatio	Conservancy Fairy Shrimp	Endangered	Special	IUCN - Endangere d
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangere d
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
Branchinecta coloradensis	Colorado Fairy Shrimp			
Hyalella spp.	Hyalella spp.			
Stygobromus spp.	Stygobromus spp.			
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Pogonichthys macrolepidotus	Sacramento splittail		Special Concern	Vulnerable - Moyle 2013
Mylopharodon conocephalus	Hardhead		Special Concern	Near-Threatened

				- Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
Anaxyrus boreas halophilus	California Toad			ARSSC
INSECTS & OTHER INVERTS				
Acentrella turbida	A Mayfly			
Apedilum spp.	Apedilum spp.			
Argia spp.	Argia spp.			
Baetis tricaudatus	A Mayfly			
Camelobaetidius warreni	A Mayfly			
Cardiocladius spp.	Cardiocladius spp.			
Chironomidae fam.	Chironomidae fam.			
Cricotopus spp.	Cricotopus spp.			
Dubiraphia spp.	Dubiraphia spp.			
Enallagma spp.	Enallagma spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Fallceon quilleri	A Mayfly			
Glossosomatidae fam.	Glossosomatidae fam.			
Gumaga griseola	A Bushtailed Caddisfly			
Heptageniidae fam.	Heptageniidae fam.			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Ischnura gemina	San Francisco Forktail		Special	IUCN - Vulnerable
Mystacides alafimbriatus	A Caddisfly			
Nectopsyche spp.	Nectopsyche spp.			
Ordobrevia nubifera				Not on any status lists
Pantala flavescens	Wandering Glider			

Petrophila spp.	Petrophila spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			
Protoptila spp.	Protoptila spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Serratella spp.	Serratella spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Tanytarsus spp.	Tanytarsus spp.			
Tricorythodes spp.	Tricorythodes spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Ferrissia spp.	Ferrissia spp.			
Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus spp.	Gyraulus spp.			
Margaritifera falcata	Western Pearlshell		Special	
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			
PLANTS				
Castilleja campestris succulenta	Fleshy Owl's-clover	Threatened	Endangered	CRPR - 1B.2
Downingia pusilla	Dwarf Downingia		Special	CRPR - 2B.2
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle		Special	CRPR - 1B.2
Neostapfia colusana	Colusa Grass	Threatened	Endangered	CRPR - 1B.1
Orcuttia inaequalis	San Joaquin Valley Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Orcuttia pilosa	Hairy Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Tuctoria greenei	Green's Awnless Orcutt Grass	Endangered	Rare	CRPR - 1B.1
Alnus rhombifolia	White Alder			
Arundo donax	NA			
Bidens tripartita	NA			

Callitriche longipedunculata	Longstock Water-starwort			
Cephalanthus occidentalis	Common Buttonbush			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus squarrosus	Awned Cyperus			
Datisca glomerata	Durango Root			
Downingia bicornuta	NA			
Elatine californica	California Waterwort			
Elatine rubella	Southwestern Waterwort			
Eleocharis flavescens flavescens	Pale Spikerush			
Eleocharis palustris	Creeping Spikerush			
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euphorbia hooveri	NA			Not on any status lists
Gratiola ebracteata	Bractless Hedge-hyssop			
Helenium puberulum	Rosilla			
Isoetes howellii	NA			
Juncus acuminatus	Sharp-fruit Rush			
Juncus dubius	Mariposa Rush			
Juncus usitatus	NA			Not on any status lists
Juncus xiphioides	Iris-leaf Rush			
Lasthenia ferrisiae	Ferris' Goldfields		Special	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Limnanthes douglasii rosea	Douglas' Meadowfoam			
Limnanthes douglasii striata				Not on any status lists
Lipocarpha micrantha	Dwarf Bulrush			
Ludwigia palustris	Marsh Seedbox			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Mimulus ringens	Square-stem Monkeyflower			
Myosurus minimus	NA			
Myriophyllum aquaticum	NA			
Najas guadalupensis guadalupensis	Southern Naiad			
Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Navarretia leucocephala minima	Least Navarretia			

Panicum acuminatum acuminatum				Not on any status lists
Panicum dichotomiflorum	NA			
Persicaria maculosa	NA			Not on any status lists
Phacelia distans	NA			
Plagiobothrys austiniae	Austin's Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Pogogyne douglasii	NA			
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton illinoensis	Illinois Pondweed			
Potamogeton nodosus	Longleaf Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Ranunculus sceleratus	NA			
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Sidalcea hirsuta	Hairy Checker-mallow			
Symphyotrichum lentum	Suisun Marsh Aster		Special	CRPR - 1B.2

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

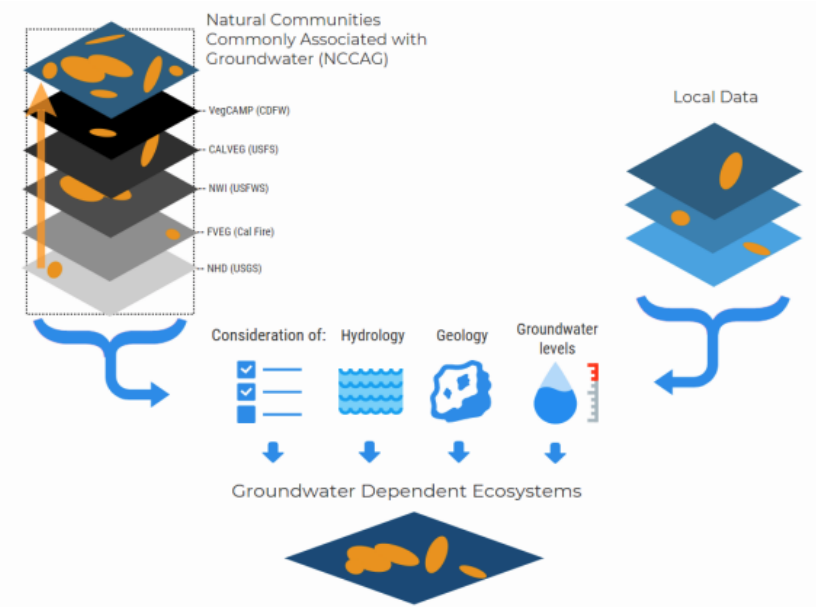


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

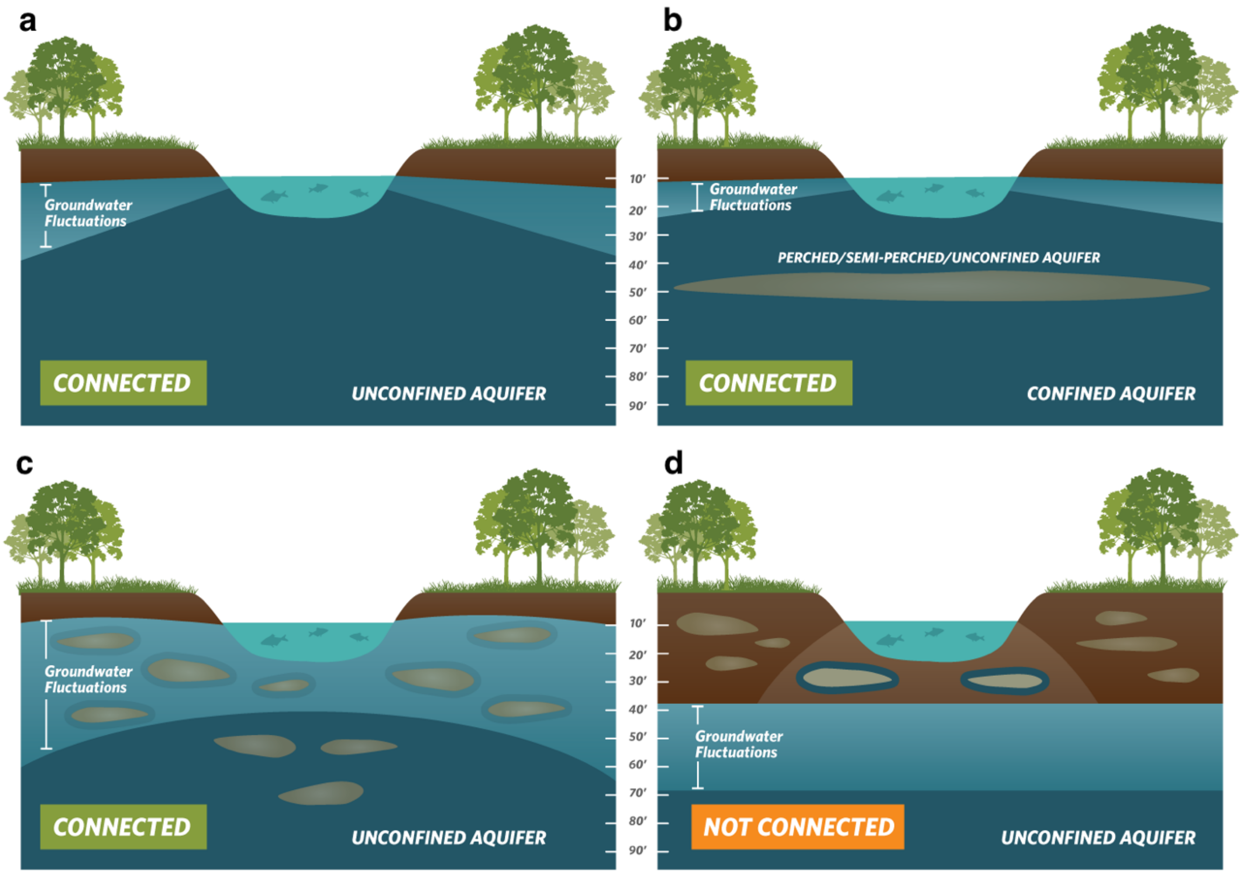

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

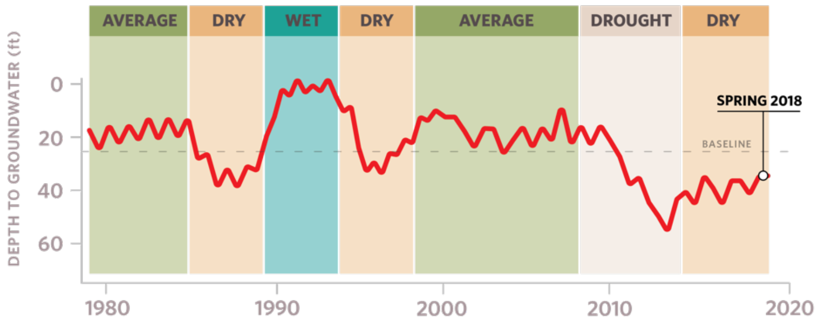

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

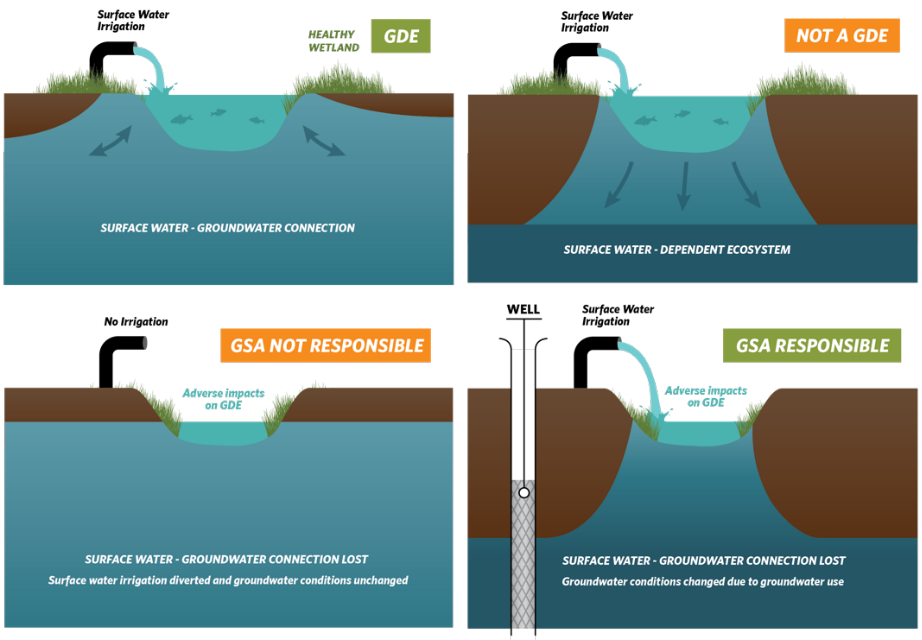


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

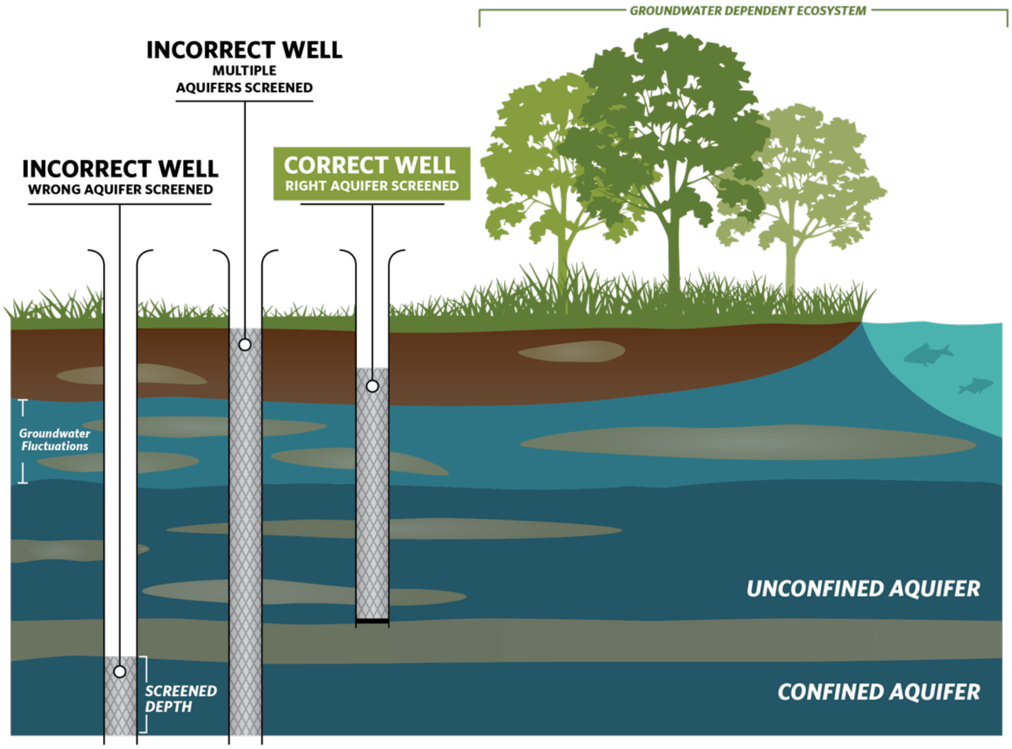


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

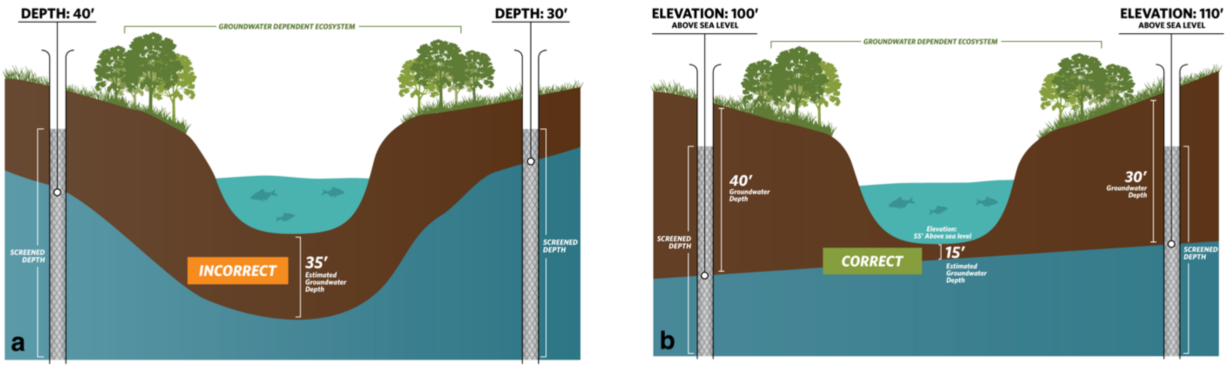


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

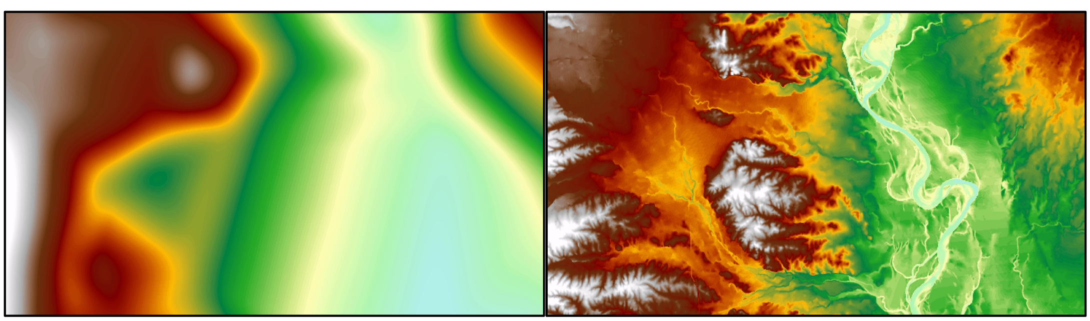


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

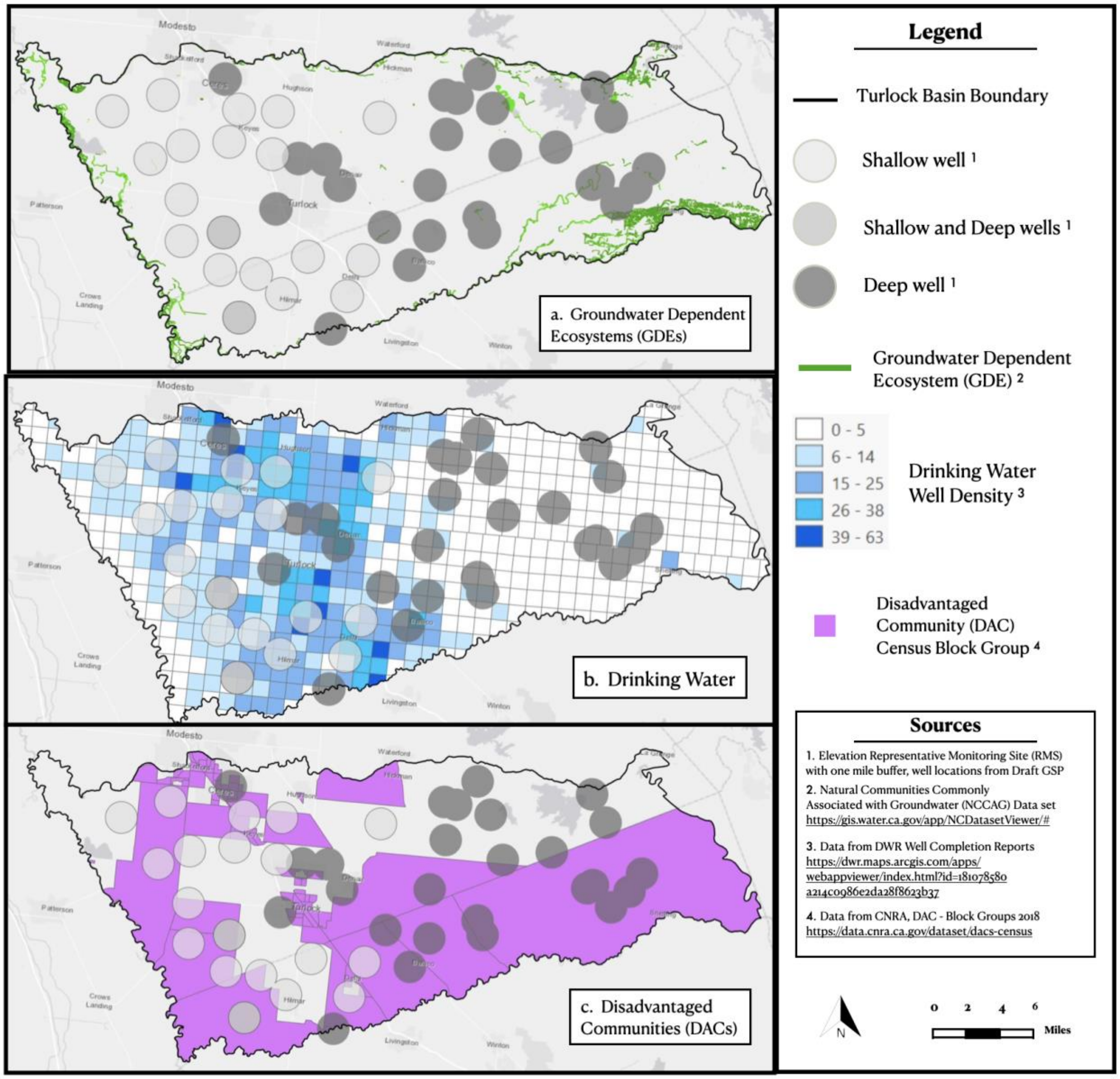


Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

September 24, 2021

Ukiah Valley Basin Groundwater Sustainability Agency
340 Lake Mendocino Dr.
Ukiah, CA 95482

Submitted via email: fisettea@mendocinocounty.org; lauraf@lwa.com

Re: Public Comment Letter for Ukiah Valley Basin Draft Groundwater Sustainability Plan

Dear Sarah Dukett,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Ukiah Valley Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Ukiah Valley Basin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Ukiah Valley Basin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **incomplete**. The GSP provides basic information on DACs, including identification by name and location on a map (Figure 2-4) as determined by the California Department of Water Resources DAC Mapping Tool, description of the size of the population in each DAC (p. 2-13), and a map of tribal lands (Figure 2-2).

The plan fails, however, to identify the population dependent on groundwater as their source of drinking water in these communities. The plan also fails to provide depth of domestic wells (such as minimum well depth, average well depth, or depth range) within the basin. These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, to support the development of water budgets using the best available information, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS

- Include a map showing domestic well locations and average well depth across the subbasin.
- Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of clarity around the monitoring well data (well location and screen depth) used to map interconnected stream reaches. The GSP took initial steps for the ISW analysis by comparing interpolated groundwater elevations to streambed elevations. The GSP states (p. 2-152): “To identify river reaches that are interconnected to groundwater, assumed streambed elevations were compared to representations of groundwater elevations above mean sea level.” Further information regarding the actual data used in the analysis is not provided, however. The GSP also describes a saturated zone threshold analysis to determine interconnected reaches to account for the assumed presence of saturated zones in areas of data gaps. The following recommendations would strengthen the clarity and completeness of the ISW evaluation.

RECOMMENDATIONS

- Provide more discussion in the GSP about the groundwater elevation data and streambed elevation data used to verify interconnected reaches. Include a map of the interpolated groundwater elevations and spatial extent of groundwater monitoring wells used to produce the map. Discuss screening depth of monitoring wells and ensure they are monitoring the shallow principal aquifer.

- Identify gaining and losing reaches on the ISW map (Figure 60).

- On the ISW map (Figure 60), clearly label the areas with data gaps. While the GSP clearly identifies data gaps and their locations in the text, we recommend that the GSP considers any segments with data gaps as potential ISWs and clearly marks them as such on maps provided in the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to lack of clarity around the monitoring well data (well location and screen depth) used to map groundwater elevations and depth to groundwater. The GSP references TNC Best Practices for using the NC Dataset (2019) as the approach used to map depth to groundwater, using the difference between land surface elevation and interpolated groundwater elevation above mean sea level. However, as mentioned above in the ISW comments, the GSP does not further describe or present monitoring well data (well location and screen depth) used to create the depth-to-groundwater maps.

The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, we found that some mapped features in the NC dataset were improperly disregarded, as described below.

- NC dataset polygons were incorrectly removed in areas adjacent to irrigated fields due to the presence of surface water. However, this removal criteria is flawed since GDEs, in addition to groundwater, can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields – simultaneously and at different temporal/spatial scales. NC dataset polygons adjacent to irrigated land can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to irrigated fields.

- NC dataset polygons were incorrectly removed based on the amount of time that they access groundwater. As presented in the GSP, assumed GDEs have access to groundwater >50% of time and assumed non-GDEs have access to groundwater <50% of the time. However, NC dataset polygons should not be assumed to be disconnected if there is any connection to groundwater (regardless of temporal percentage). Many GDEs often simultaneously rely on multiple sources of water (i.e., both groundwater and surface water), or shift their reliance on different sources on an interannual or inter-seasonal basis.

RECOMMENDATIONS

- Include a map of the interpolated groundwater elevations and spatial extent of groundwater monitoring wells used to produce the map. Discuss screening depth of monitoring wells and ensure they are monitoring the shallow principal aquifer.
- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons and to verify whether polygons in the NC Dataset are supported by groundwater.
- Use a baseline period (we recommend 10 years from 2005 to 2015) to characterize groundwater conditions over multiple water year types.
- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included into the water budget. The integration of native vegetation into the water budget is **insufficient**. The water budget did not explicitly include the current, historical, and projected demands of native vegetation. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.
- State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

[1] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[2] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the Communication and Engagement Plan included in the GSP (Appendix 1-A).

We commend the GSA for their outreach to tribal members in the basin and for including a tribal member on the Technical Advisory Committee. However, we note the following deficiencies with other aspects of the stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms. They include attendance at public meetings, stakeholder email list, mailings of flyers and brochures, and updates to the GSP website.
- Environmental agencies are listed as stakeholders in Table 2-6, but specific engagement and outreach methods are not described.
- The Stakeholder Outreach Plan does not include a plan for continual opportunities for engagement through the *implementation* phase of the GSP for DACs, domestic well owners, and environmental stakeholders.

RECOMMENDATIONS
• Include a more detailed and robust Communication and Engagement Plan that describes active and targeted outreach to engage DAC members, domestic well owners, and environmental stakeholders during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[4] and establishing minimum thresholds.[5,6]

[3] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]
[4] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
[5] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[6] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Disadvantaged Communities and Drinking Water Users
For chronic lowering of groundwater levels for drinking water users, the GSP describes impacts to domestic drinking water wells when defining undesirable results, and the GSP describes how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results in the basin. This discussion is provided in Appendix 3-A, Shallow Well Protection Memorandum. The GSP does not however, specifically analyze direct and indirect impacts on DACs and tribes or evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs and tribes.

Minimum thresholds for two constituents of concern (COCs), nitrate and specific conductivity, are set at the primary (nitrate as N) or secondary (specific conductivity) maximum contaminant levels (MCLs). However, the GSP does not set SMC for the other naturally occurring constituents in the basin (i.e., iron, manganese, boron).

For degraded water quality, the GSP only includes a very general discussion of indirect impacts to drinking water users when defining undesirable results and evaluating the cumulative or indirect impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs or tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs or tribes.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels (in addition to describing impacts to drinking water users).

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users, DACs and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to “Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act.”[7]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.

- Set minimum thresholds and measurable objectives for the naturally occuring COCs in the basin (iron, manganese, boron). Ensure they align with drinking water standards[8].

Groundwater Dependent Ecosystems and Interconnected Surface Waters
We commend the GSA for their comprehensive analysis of SMC for GDEs and ISWs. The GSP analyzes the impacts on GDEs when defining undesirable results for three sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, and depletions of

[7] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.
[8] “Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues.” [23 CCR §354.34(c)(4)]

interconnected surface waters). Furthermore, the GSP evaluates the impacts of proposed minimum thresholds on GDEs or environmental beneficial users of surface water for these sustainability indicators. The GSP considers GDEs when establishing measurable objectives and evaluates the measurable objectives based on GDE water needs.

RECOMMENDATION
● After re-analyzing the extent of GDEs and ISWs in the basin based on our comments above, re-evaluate the SMC to ensure they are protective of GDEs and surface water users in the basin.

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[9] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the GSP did not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

The GSP includes climate change into precipitation, evapotranspiration, and surface water flow terms of the projected water budget. However, the GSP does not calculate a sustainable yield based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, domestic well owners, and tribes.

RECOMMENDATIONS
● Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions. ● Calculate sustainable yield based on the projected water budget with climate change incorporated.

[9] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of clarity around the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, tribes, and GDEs. These beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[10].

The GSP states (p. 3-11): "Importantly, monitoring well density is appropriate to extrapolate seasonal groundwater elevation maps to support the shallow well protection analysis, GDE impact analysis, and to monitor seasonal changes in hydraulic gradients that indicate changes in ISW depletion. Implementation actions are proposed to cover data gaps that still exist within the network and improvements that may help such assessments." Thus the GSP recognizes the importance of filling data gaps, however does not provide specific plans, well locations shown on a map, or a timeline to fill the data gaps. Without a map of proposed new monitoring well locations, a determination cannot be made regarding the adequacy of the monitoring network for sustainability indicators going forward into the GSP implementation phase.

RECOMMENDATIONS

- Provide maps that overlay monitoring well locations with the locations of DACs, domestic wells, tribes, and GDEs to clearly identify potentially impacted areas. Increase the number of representative monitoring points (RMPs) across the subbasin for all groundwater condition indicators. Prioritize proximity to GDEs and drinking water users when identifying new RMPs.

- Provide specific plans to fill data gaps in the monitoring network. Evaluate how the gathered data will be used to identify and map GDEs and ISWs, and identify DACs and shallow domestic well users that are vulnerable to undesirable results.

- Determine what biological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to beneficial users of groundwater such as DACs, drinking water users, and tribes.

[10] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

We commend the GSA for including habitat and stream restoration projects in the GSP (described in Sections 4.1 and 4.3.2.2). The GSP discusses the manner in which these projects will benefit ecosystems, but does not discuss the manner in which DACs, drinking water users, and tribes may be benefitted or impacted by identified projects and management actions. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

RECOMMENDATIONS

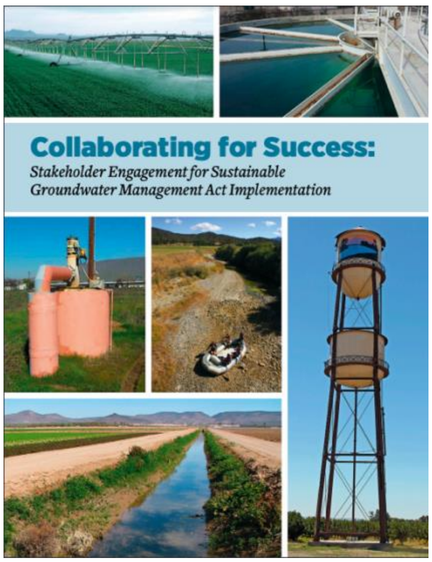
- For DACs and domestic well owners, include discussion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.
- For DACs, domestic well owners, and tribes, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.
- Recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[11].
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[11] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



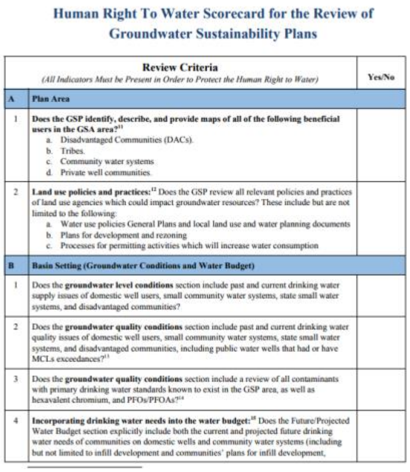
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

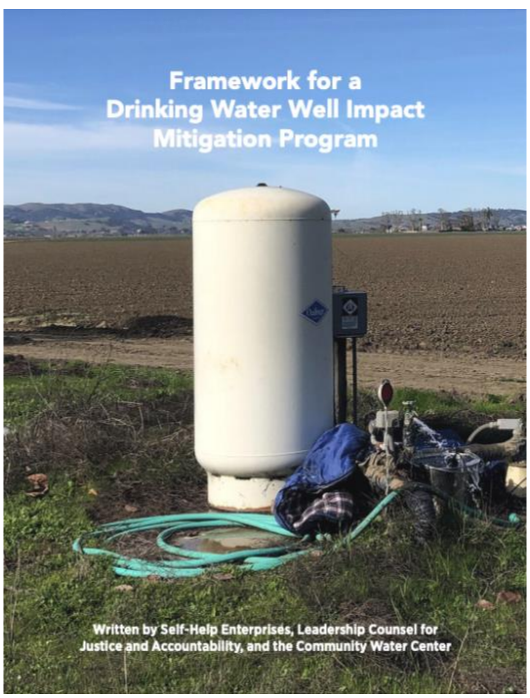


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria (All Indicators Must be Present in Order to Protect the Human Right to Water)	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

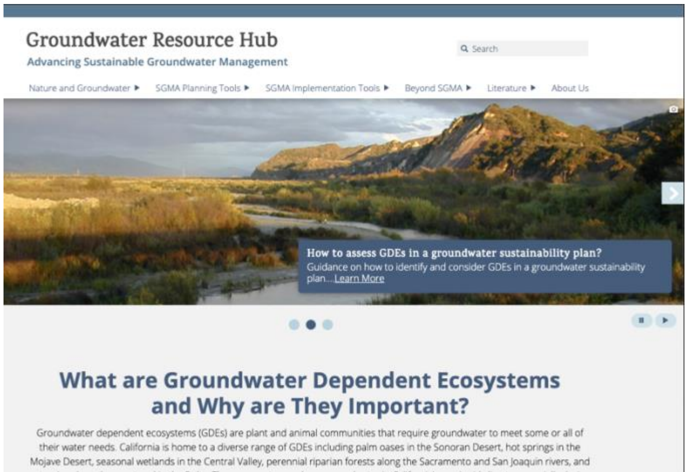
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



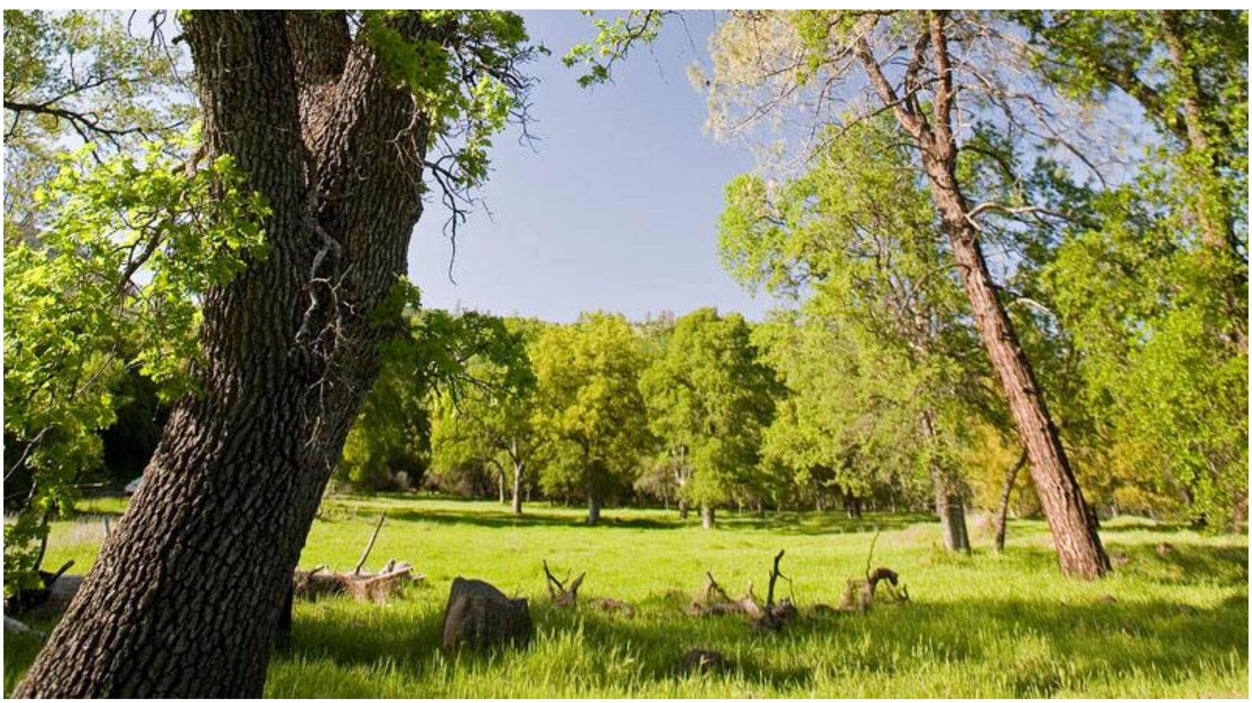
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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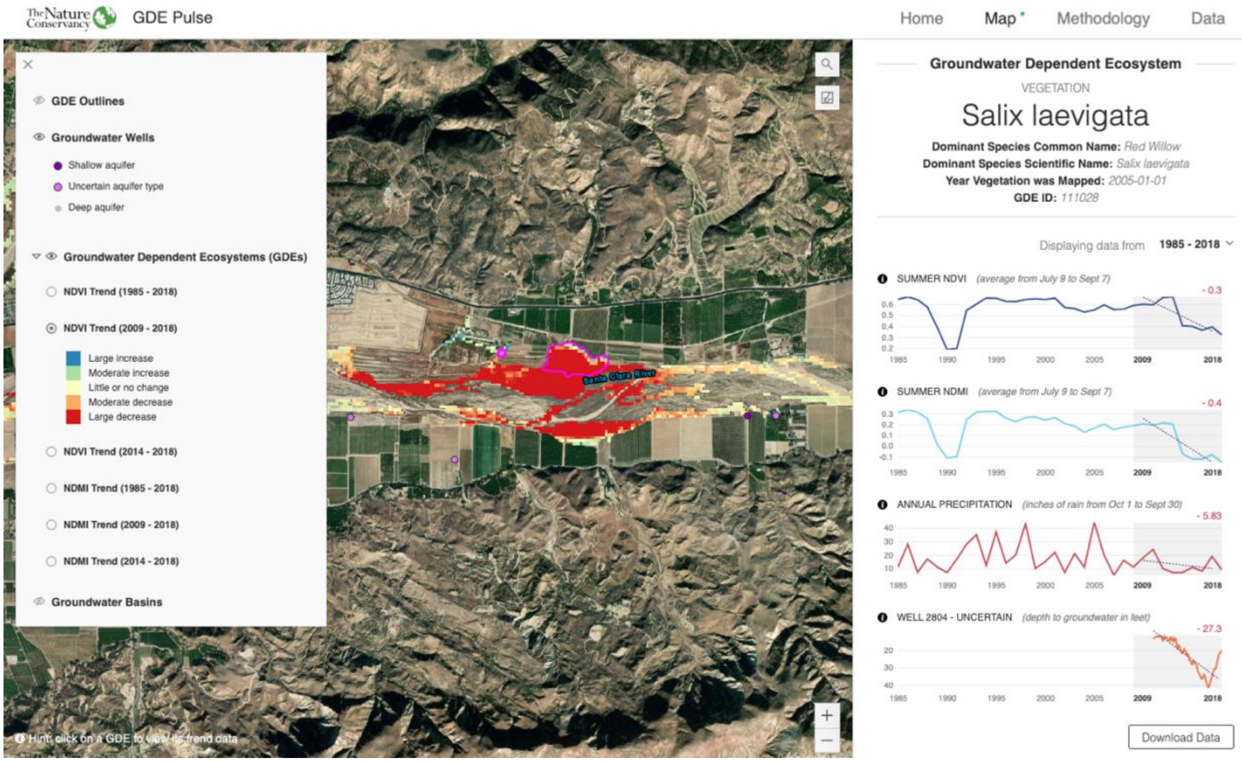
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

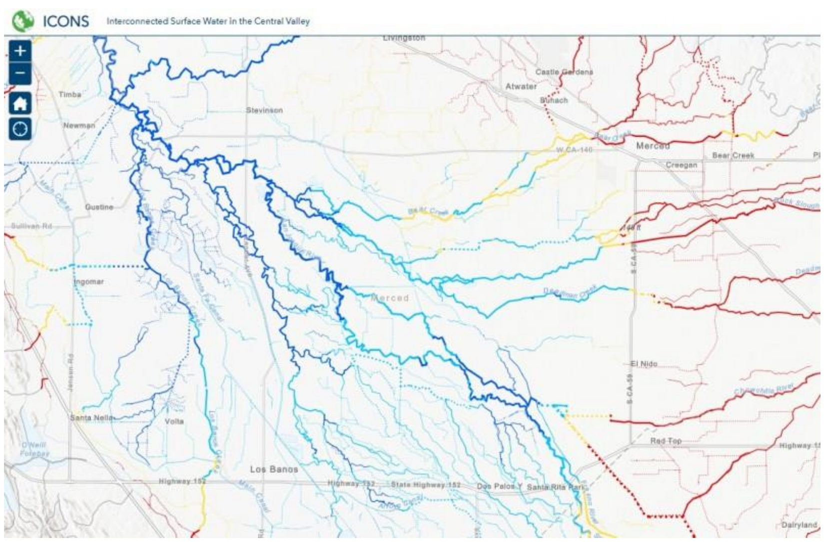
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Ukiah Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Ukiah Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cypseloides niger	Black Swift	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			

Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
FISH				
Oncorhynchus mykiss - CCC winter	Central California coast winter steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CCC fall	California Coast fall Chinook salmon	Threatened	Special	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Dicamptodon tenebrosus	Pacific Giant Salamander			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Taricha rivularis	Red-bellied Newt			ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Aeshna spp.	Aeshna spp.			
Aeshnidae fam.	Aeshnidae fam.			
Ambrysus spp.	Ambrysus spp.			
Amiocentrus aspilus	A Caddisfly			
Ampumixis dispar				Not on any status lists
Anacaena spp.	Anacaena spp.			
Argia spp.	Argia spp.			
Baetis spp.	Baetis spp.			
Belostomatidae fam.	Belostomatidae fam.			

Calineuria californica	Western Stone			
Callibaetis spp.	Callibaetis spp.			
Centroptilum spp.	Centroptilum spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chloroperlidae fam.	Chloroperlidae fam.			
Cleptelmis addenda				Not on any status lists
Cloeodes excogitatus	A Mayfly			
Cordulegaster dorsalis	Pacific Spiketail			
Deuterophlebia spp.	Deuterophlebia spp.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Dolophilodes spp.	Dolophilodes spp.			
Elodes spp.	Elodes spp.			
Enochrus spp.	Enochrus spp.			
Epeorus spp.	Epeorus spp.			
Ephemerella spp.	Ephemerella spp.			
Ephydridae fam.	Ephydridae fam.			
Eubrianax edwardsii				Not on any status lists
Eucorethra underwoodi				Not on any status lists
Fallceon quilleri	A Mayfly			
Farula spp.	Farula spp.			
Graptocorixa spp.	Graptocorixa spp.			
Gumaga spp.	Gumaga spp.			
Heptageniidae fam.	Heptageniidae fam.			
Heteroplectron californicum	A Caddisfly			
Hydraena spp.	Hydraena spp.			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ironodes spp.	Ironodes spp.			
Isoperla spp.	Isoperla spp.			
Ithytrichia clavata	A Caddisfly			
Laccobius spp.	Laccobius spp.			
Lepidostoma spp.	Lepidostoma spp.			
Leucrocuta spp.	Leucrocuta spp.			
Malenka spp.	Malenka spp.			
Maruina lanceolata				Not on any status lists
Meringodixa chalonensis				Not on any status lists

Nixe kennedyi	A Mayfly			
Ochrotrichia spp.	Ochrotrichia spp.			
Octogomphus specularis	Grappletail			
Oecetis spp.	Oecetis spp.			
Optioservus spp.	Optioservus spp.			
Ordobrevia nubifera				Not on any status lists
Paraleptophlebia spp.	Paraleptophlebia spp.			
Parapsyche spp.	Parapsyche spp.			
Perlidae fam.	Perlidae fam.			
Procloeon venosum	A Mayfly			
Psephenus falli				Not on any status lists
Pteronarcys spp.	Pteronarcys spp.			
Rhyacophila spp.	Rhyacophila spp.			
Sanfilippodytes spp.	Sanfilippodytes spp.			
Serratella spp.	Serratella spp.			
Sialis spp.	Sialis spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Stictotarsus spp.	Stictotarsus spp.			
Suwallia spp.	Suwallia spp.			
Sympetrum occidentale				Not on any status lists
Tinodes spp.	Tinodes spp.			
Tipulidae fam.	Tipulidae fam.			
Tricorythodes spp.	Tricorythodes spp.			
Uvarus subtilis				Not on any status lists
Wormaldia spp.	Wormaldia spp.			
Zaitzevia spp.	Zaitzevia spp.			
Zapada spp.	Zapada spp.			
MAMMALS				
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Margaritifera falcata	Western Pearlshell		Special	
Ferrissia spp.	Ferrissia spp.			
Juga spp.	Juga spp.			
Physa spp.	Physa spp.			
Anodonta californiensis	California Floater		Special	

Gonidea angulata	Western Ridged Mussel		Special	
PLANTS				
Alopecurus saccatus	Pacific Foxtail			
Arundo donax	NA			
Calochortus uniflorus	Shortstem Mariposa Lily		Special	CRPR - 4.2
Carex nudata	Torrent Sedge			
Cicendia quadrangularis	Oregon Microcala			
Cypripedium californicum	California Lady's-slipper			
Eryngium aristulatum aristulatum	California Eryngo			
Gratiola ebracteata	Bractless Hedge-hyssop			
Juncus xiphioides	Iris-leaf Rush			
Lilium pardalinum pardalinum	Leopard Lily			
Limnanthes bakeri	Baker's Meadowfoam		Rare	CRPR - 1B.1
Limnanthes douglasii nivea	Douglas' Meadowfoam			
Limnanthes douglasii rosea	Douglas' Meadowfoam			
Mimulus guttatus	Common Large Monkeyflower			
Paspalum distichum	Joint Paspalum			
Perideridia kelloggii	Kellogg's Yampah			
Pleuropogon californicus californicus				Not on any status lists
Salix exigua exigua	Narrowleaf Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Sequoia sempervirens				

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

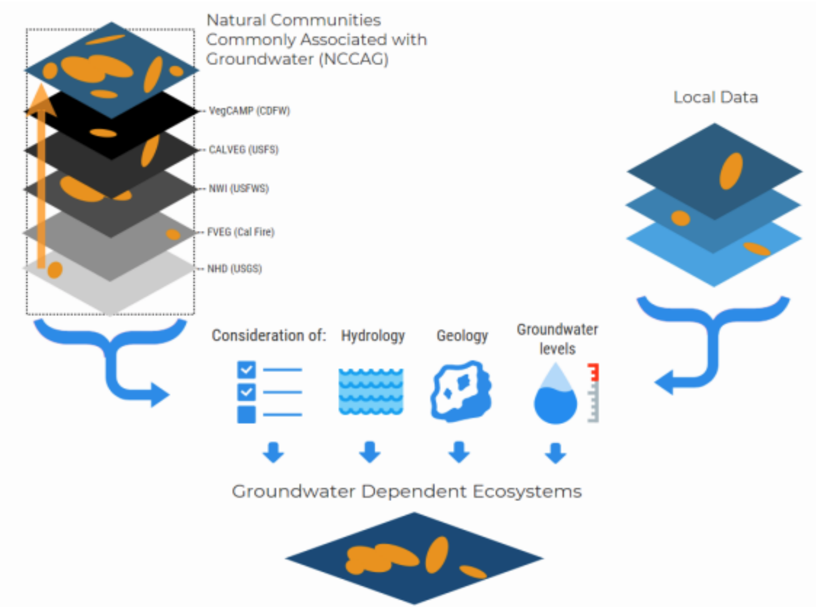


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

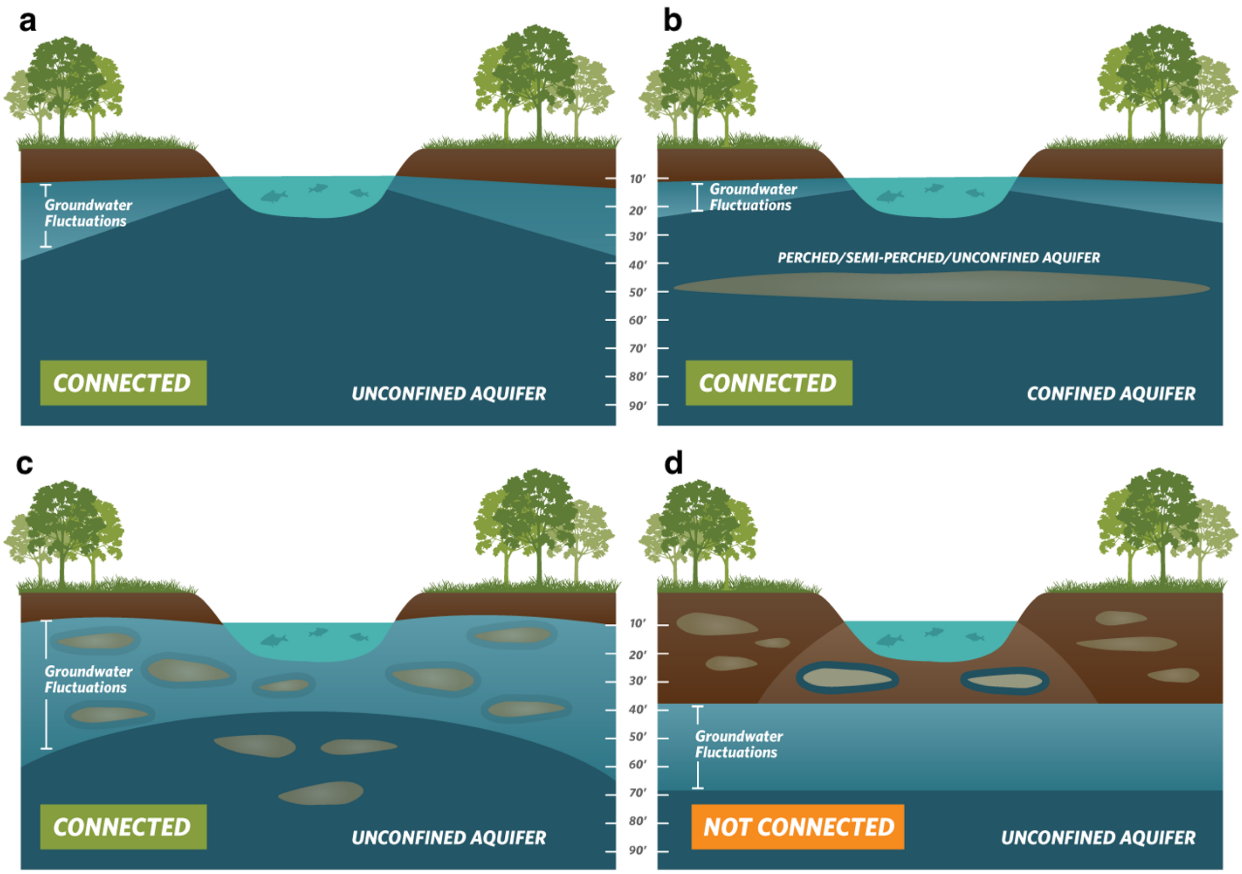

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

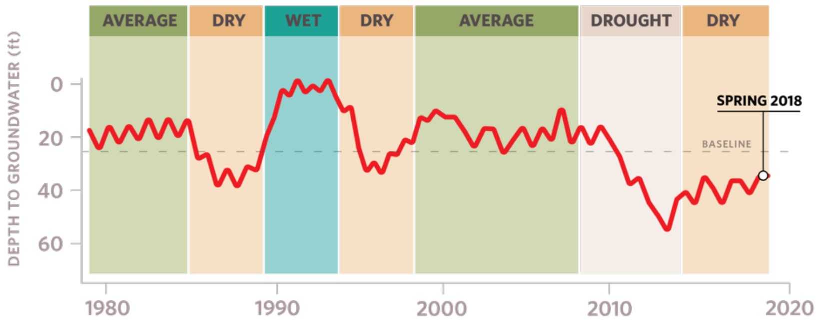

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

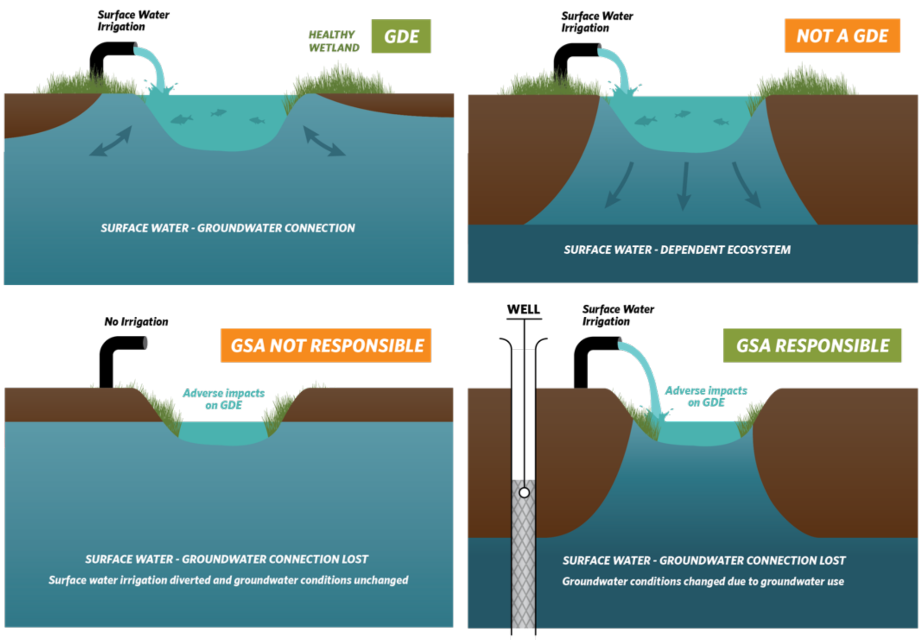

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

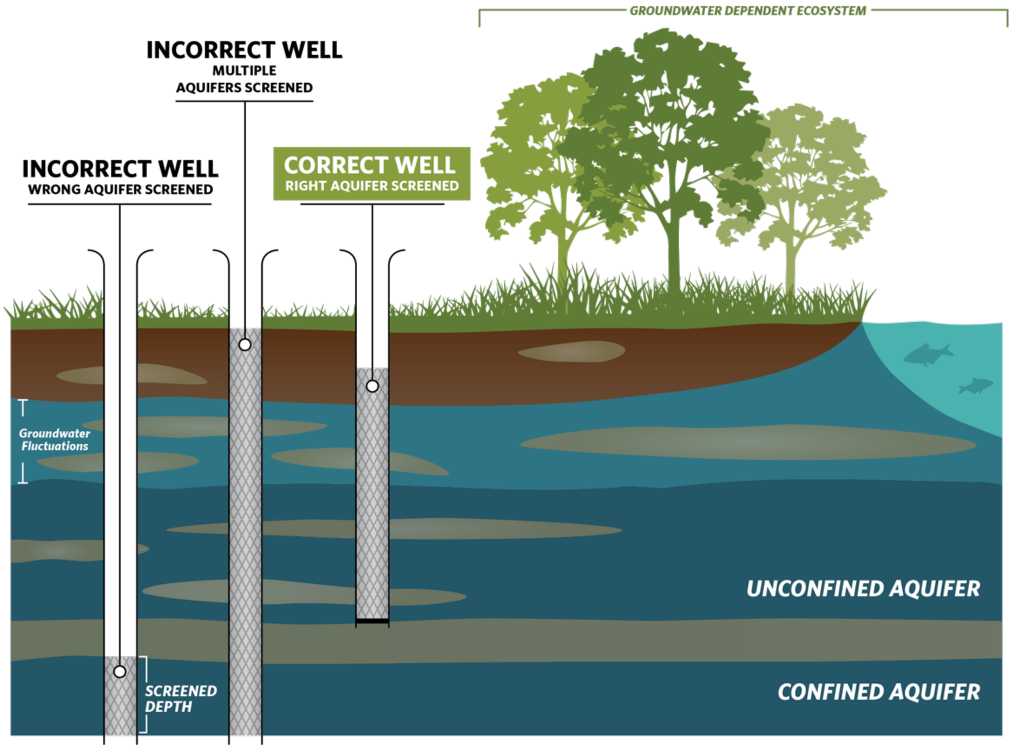

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

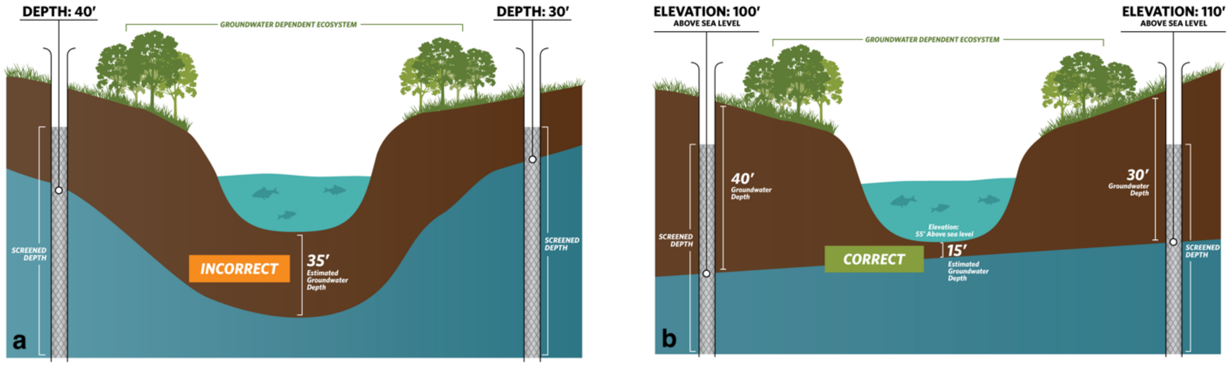

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

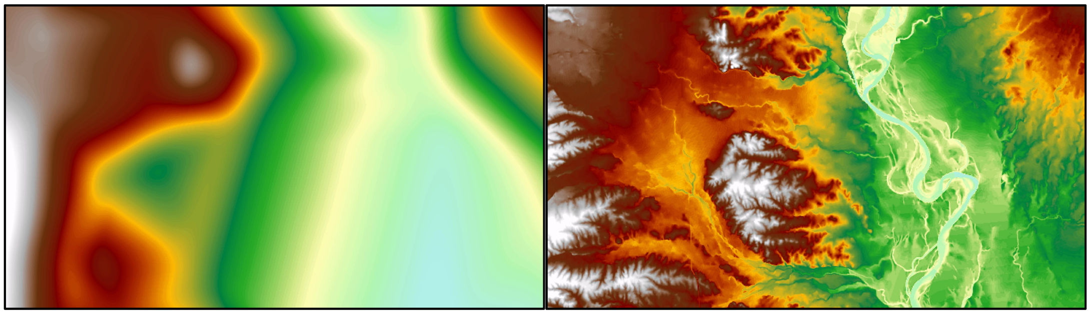

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

December 20, 2021

Pauma Valley GSA
c/o Yuima Municipal Water District
P.O. Box 177
Pauma Valley, CA 92061-0177

Submitted via email: gsa@yuimamwd.com

Re: Public Comment Letter for Upper San Luis Rey Valley Draft GSP

Dear Amy Reeh,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Upper San Luis Rey Valley Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.

    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Upper San Luis Rey Valley Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Upper San Luis Rey Valley Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. We note the following deficiencies with the identification of these key beneficial users:

- The GSP fails to identify and map the locations of DACs and describe the size of each DAC population within the subbasin.
- The GSP identifies the San Luis Rey Tribe as a stakeholder within the subbasin, but does not provide a map of the tribal lands or tribal interests.
- The GSP fails to provide a map of domestic well density in the subbasin. The GSP should include a map of domestic well locations or density, and provide the depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin. This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the subbasin.
- The GSP fails to identify the population dependent on groundwater as their source of drinking water in the subbasin. Specifics are not provided on how much each DAC community relies on a particular water supply (e.g., what percentage is supplied by groundwater).

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

RECOMMENDATIONS

- Describe and map the locations of DACs and provide the population of each DAC. The DWR DAC mapping tool can be used for this purpose.[2] Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).
- Provide a map of tribal lands and describe tribal interests in the subbasin.
- Provide a domestic well density map and include average well depth across the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP combines the ISW analysis and GDE analysis into one section of the GSP (Section 3.3.4.4 Interconnected Surface Water Systems and Groundwater Dependent Ecosystems), and provides no analysis for ISWs. The only statement the GSP makes regarding ISW is the following (p. 3-21): *"Given the depth to groundwater in much of the basin, percolation from streamflow is thought to be largely in free fall conditions; that is, the streams are not in direct hydraulic connection with the underlying water table and aquifer system so that surface recharge must percolate through the unsaturated zone before becoming accessible to groundwater pumping."* The GSP does not provide depth-to-water data, however, except to present a shaded area representing depth to water of less than or equal to 20 feet on Figure 3-23 (Areas of Potentially Groundwater Dependent Vegetation where Depth to Water Less than or Equal to 20 Feet).

We note it is common practice to utilize a threshold of 50 feet below groundwater surface to indicate a disconnected stream reach.[3,4] Refer to our other recommendations below to provide a complete analysis of ISWs in the subbasin.

RECOMMENDATIONS

- Use a screening depth of 50 feet to determine which stream reaches in the subbasin are potentially interconnected with groundwater.
- Provide a map of streams in the subbasin. Clearly label reaches as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.
- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.

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[2] The DWR DAC mapping tool is available online at: https://gis.water.ca.gov/app/dacs/.

[3] Jasechko, S. et al. 2021. Widespread potential loss of streamflow into underlying aquifers across the USA. Nature, 591: 391-395. doi: https://doi.org/10.1038/s41586-021-03311-x

[4] The Nature Conservancy. 2021. ICONS Tool. Available at: https://icons.codefornature.org/

- Overlay the subbasin's stream reaches on depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis.

- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using National Wetlands Inventory (NWI) mapping and San Diego Association of Governments (SANDAG) regional vegetation mapping. The GSP uses modeled depth-to-groundwater data from the period 1991 to 2020 to characterize areas where the depth to groundwater was less than 20 feet. The GSP could be improved by including a summary of the model well data in the main GSP text, including the locations of wells and screening depths of wells, to ensure that the wells are monitoring the shallow principal aquifer. Furthermore, it is common practice to utilize a threshold of 30 feet below groundwater surface to indicate areas where potential GDEs are accessing groundwater.[5]

The GSP states (p. 3-21): *"Figure 3-23 shows vegetation areas located within areas estimated by the groundwater model (see Section 3.3.5.1) to have groundwater within 20 ft of land surface. This depth is considered to be the typical extinction depth for most deep-rooted riparian vegetation; most roots of riparian vegetation would not be able to access groundwater resources if groundwater levels were deeper than this threshold. However, as noted previously, these areas (and their groundwater dependency) need to be evaluated by field investigation and through the collection of additional data."* We recommend that the GSP clarify whether these GDEs are retained as potential GDEs in the GSP.

RECOMMENDATIONS

- Retain vegetation polygons with depth to groundwater of 30 feet or less as "Potential GDEs" unless data indicate otherwise.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape. Show the location of wells used in the analysis on the depth-to-groundwater contour map. Discuss screening depths of the wells in the GSP text.

[5] Rohde, M. et al. 2018. Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

- If insufficient data are available to describe groundwater conditions within or near vegetation polygons, include those polygons as “Potential GDEs” in the GSP until data gaps are reconciled in the monitoring network.

- Provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin and note any threatened or endangered species (see Attachment C in this letter for a list of freshwater species located in the Upper San Luis Rey Valley Subbasin).

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[6,7] The integration of native vegetation into the water budget is **insufficient**. The water budget did not include the current, historical, and projected demands of native vegetation. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the subbasin.

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.

- State whether or not there are managed wetlands in the subbasin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development

Stakeholder engagement during GSP development is **insufficient**. SGMA’s requirement for public notice and engagement of stakeholders is not fully met by the description in the Public Involvement Plan.[8]

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[6] “’Water use sector’ refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation.” [23 CCR §351(al)]

[7] “The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.” [23 CCR §354.18]

[8] “A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin.” [23 CCR §354.10(d)(3)]

The GSP documents direct outreach to the San Luis Rey Indian Water Authority as well as tribal representatives, and notes that GSA will convene a Tribal Work Group to encourage tribal participation. However, we note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents plans for public involvement and engagement in very general terms. Plans for public notice and engagement activities include information dissemination through a project hotline and hard copies, engaging multicultural communities through relevant organizations and communities in the stakeholder list, and developing key project materials in English and Spanish to ensure information access. The GSP does not state whether there was direct engagement with DACs or environmental stakeholders, nor does it clearly identify the names of organizations or representatives for either group of beneficial users.

- The plan does not include documentation on how stakeholder input from the above-mentioned outreach and engagement was solicited, considered and incorporated into the GSP development process.

- The GSP does not include a detailed plan for continual opportunities for engagement through the *implementation* phase of the GSP that is specifically directed to DACs, domestic well owners, and environmental stakeholders within the subbasin.

RECOMMENDATIONS
• In the Public Involvement Plan, describe active and targeted outreach to engage DACs, drinking water users, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. • Provide documentation on how stakeholder input was incorporated into the GSP development process. • Provide documentation on how tribal concerns were considered during the GSP development process after initial outreach. • Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the subbasin.[9]

[9] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[10,11,12]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the plan states (p. 4-10): "*The MTs are lower than historical lowest groundwater levels and are based upon the minimum level that would continue to allow production from each well.*" The GSP also states (p. 4-6): *"It is acknowledged that current sustainability criteria may not be protective of all domestic wells in the basin for which information is largely unavailable. Therefore, additional data will need to be collected following implementation of the GSP to understand where these wells are located, how they operate, and what historical conditions have been in order to determine how beneficial use at these locations can be protected. At the five-year review period, it may be necessary to adjust sustainability management criteria for water levels to accommodate new information about domestic wells and water use."* Therefore, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users, especially given the absence of a domestic well mitigation plan in the GSP. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, nor does it describe how the groundwater level minimum thresholds are consistent with Human Right to Water policy and will avoid significant and unreasonable impacts on these beneficial users.[13]

For degraded water quality, identified constituents of concern (COCs) in the subbasin are total dissolved solids (TDS) and nitrate. Minimum thresholds for these constituents are set at basin water quality objectives of 800 mg/L for TDS and 45.0 mg/L for Nitrate-NO3. However, according to the state's anti-degradation policy,[14] high water quality should be protected and is only allowed to worsen to the maximum contaminant level (MCL) if a finding is made that it is in the best interest of the people of the State of California. No analysis has been done and no such finding has been made. Furthermore, the plan sets measurable objectives for TDS at current ambient concentrations (assumed to be 607 mg/L, the median of available basin wide concentrations). The value of 607 mg/L is above the recommended MCL for TDS and not protective of drinking water users.

The GSP only includes a very general discussion of impacts on drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds for degraded water quality. The GSP does not, however, mention or discuss direct and indirect impacts on DACs, drinking water users, or tribes when defining undesirable results for degraded

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[10] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
[11] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[12] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]
[13] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3
[14] Anti-degradation Policy https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf

water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels. Include information on the impacts during prolonged periods of below average water years.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users, DACs, and tribes within the subbasin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be fully or partially de-watered at the minimum threshold.

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality.[15] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[16]

- Set minimum thresholds and measurable objectives that are protective of drinking water users.

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC for chronic lowering of groundwater levels. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users.

Sustainable management criteria for depletion of interconnected surface water are established by proxy using groundwater levels. Minimum thresholds are defined as groundwater levels falling below the lowest groundwater level since 2015 in the areas identified to have vegetation that is potentially groundwater dependent. However, if minimum thresholds are set to drought-level low

[15] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]
[16] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

groundwater levels and the subbasin is allowed to operate at or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse. No analysis or discussion is presented to describe how the SMC will affect beneficial users, and more specifically GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin.[17] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[18]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[19] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[8,20]

[17] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[18] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[19] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]
[20] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[21] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[22] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP would benefit from clearly and transparently incorporating climate change into the projected water budget. Additionally, the plan does not appear to consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP would benefit from clearly and transparently incorporating appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring and their consideration is not required (only suggested) by DWR, their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP could be improved by integrating climate change projections into key inputs (e.g., precipitation, evapotranspiration, and surface water flows) of the projected water budget. Furthermore, the sustainable yield appears to be calculated based on the historic water budget instead of a projected water budget that incorporates climate change projections. If the water budgets are incomplete, including the omission of climate change effects on the projected water budget, omission of extremely wet and dry scenarios, and omission of climate change projections in the sustainable yield calculations, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as DACs, ecosystems, tribes, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

[21] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]
[22] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, tribes, GDEs, and ISWs in the subbasin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[23]

Figure 4-1 (Representative Monitoring Sites for Evaluating Sustainable Management Criteria) shows insufficient representation of DACs, drinking water users, and tribes for groundwater elevation monitoring. Figure 5-2 (Monitoring Well Locations - Water Quality) shows insufficient representation of DACs, drinking water users, and tribes for water quality monitoring.

The GSP states (p. 5-5): "*With the potential that riparian habitat exists along the San Luis Rey River within the Pala and/or Pauma Subbasins, the existence of such habitat should be evaluated, and if such habitat is found to exist within the subbasins, monitoring should be conducted to evaluate the condition of such habitat and how that condition informs the sustainability goals and criteria in the GSP*." However, the GSP does not provide specific plans, such as locations or a timeline, to fill the data gaps for GDEs and ISWs.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, tribes, and GDEs to clearly identify monitored areas.
- Increase the number of RMSs in the shallow aquifer across the subbasin as needed to map ISWs and adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, tribes, GDEs, and ISWs when identifying new RMSs.
- Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, tribes, and GDEs.
- In Section 5.5, further describe biological monitoring along the San Luis Rey River that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin. Additional studies of GDEs and groundwater - surface water interactions are briefly discussed in Chapter 6 (Projects and Management Actions), but very few details are provided.

[23] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, tribes, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

While the plan describes potential recharge projects within the subbasin, these are classified as Tier 2 and Tier 3 projects and management actions with no concrete plans in place during the GSP planning horizon. Moreover, the GSP fails to describe these projects' explicit benefits to environmental beneficial users, DACs, or drinking water users.

We note that the plan does not include a domestic well mitigation program to avoid significant and unreasonable loss of drinking water. We strongly recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[24]

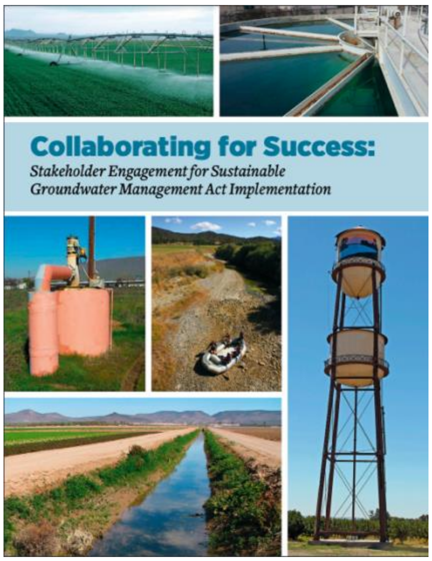
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[24] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

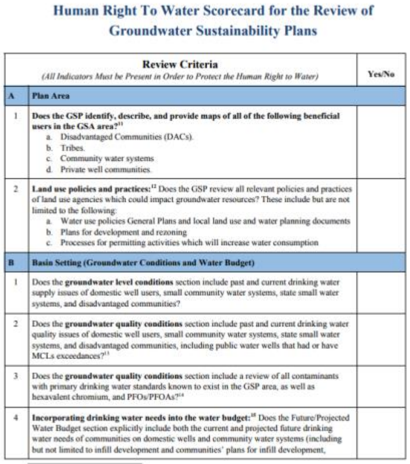
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

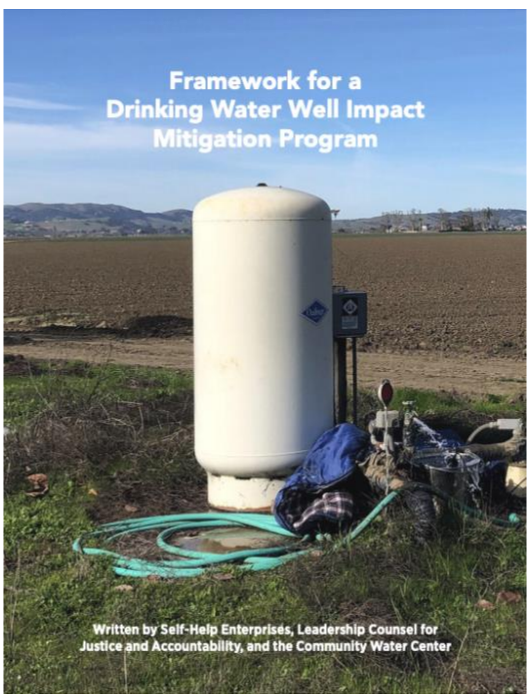


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

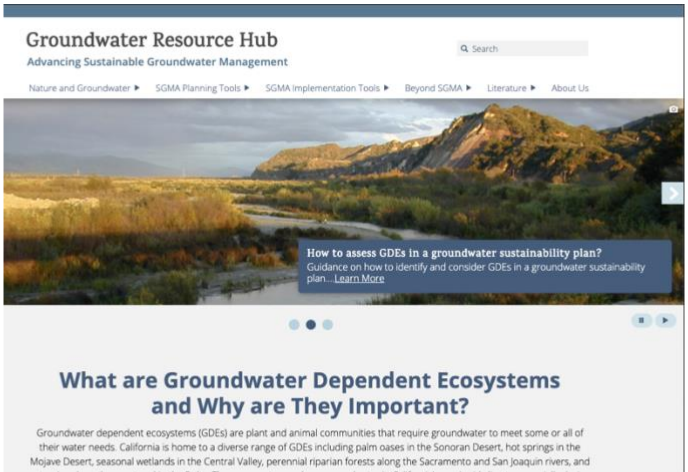
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



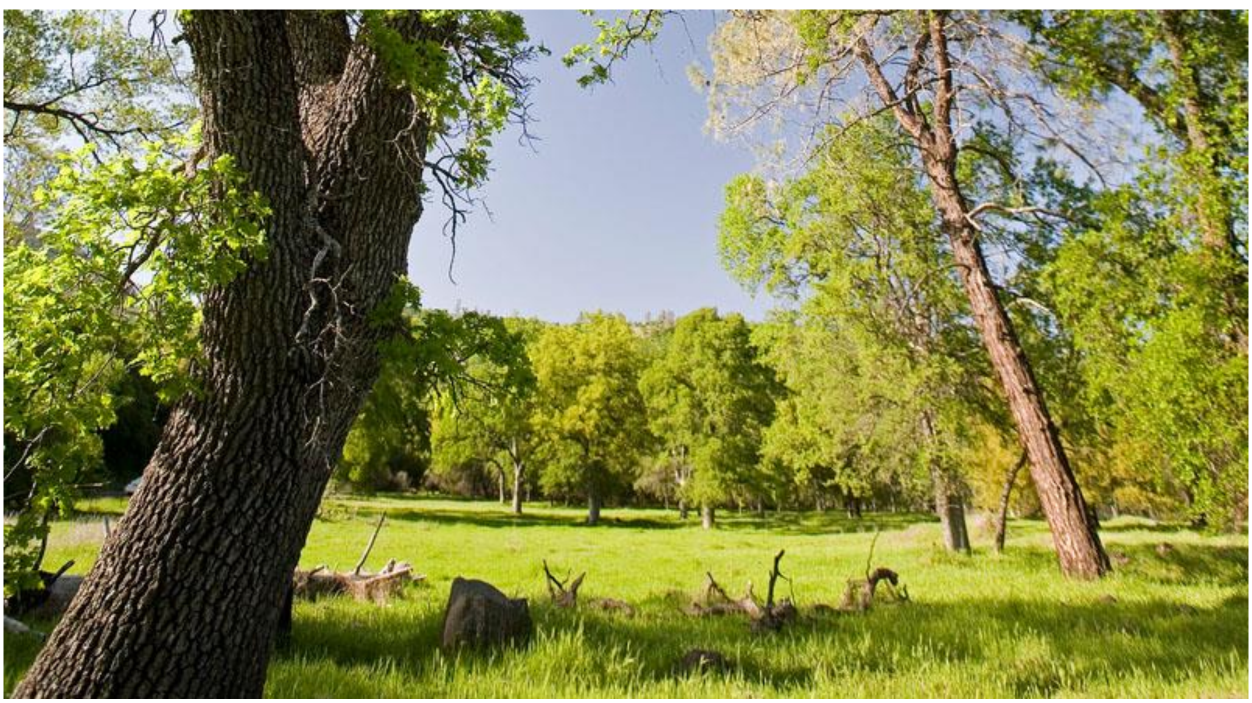
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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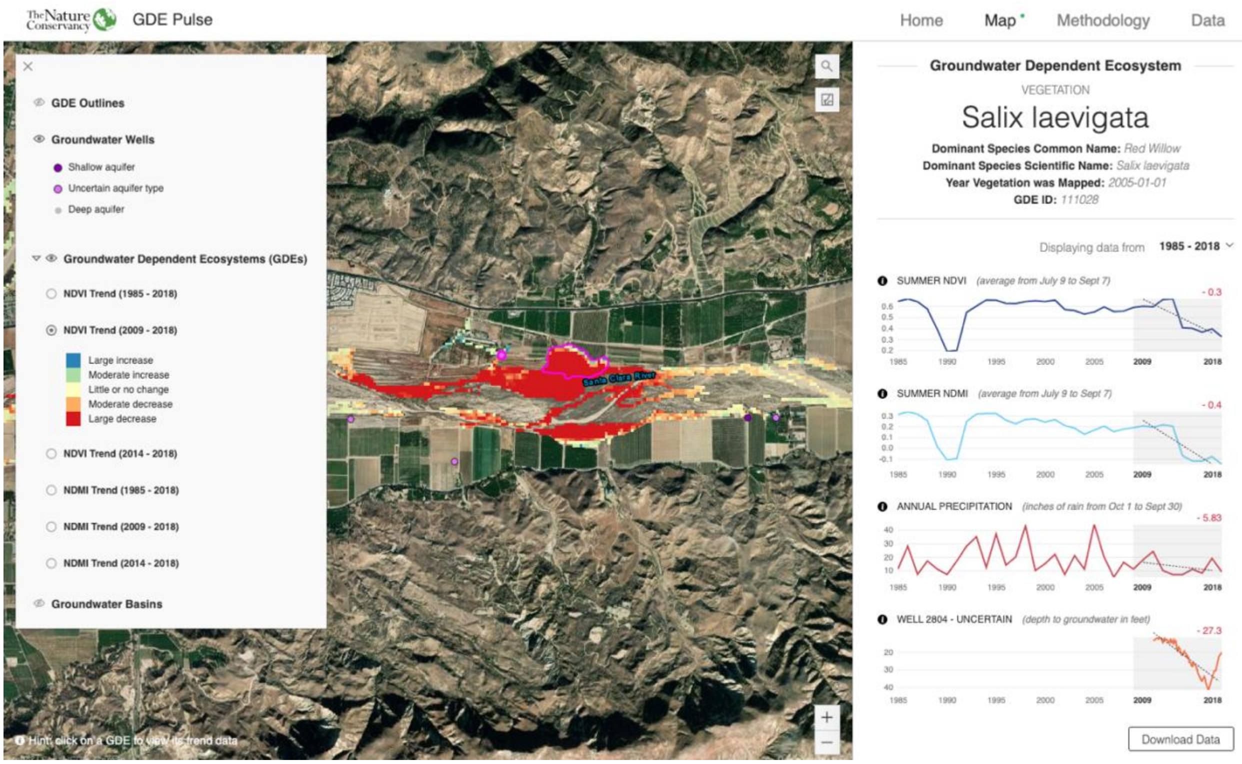
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

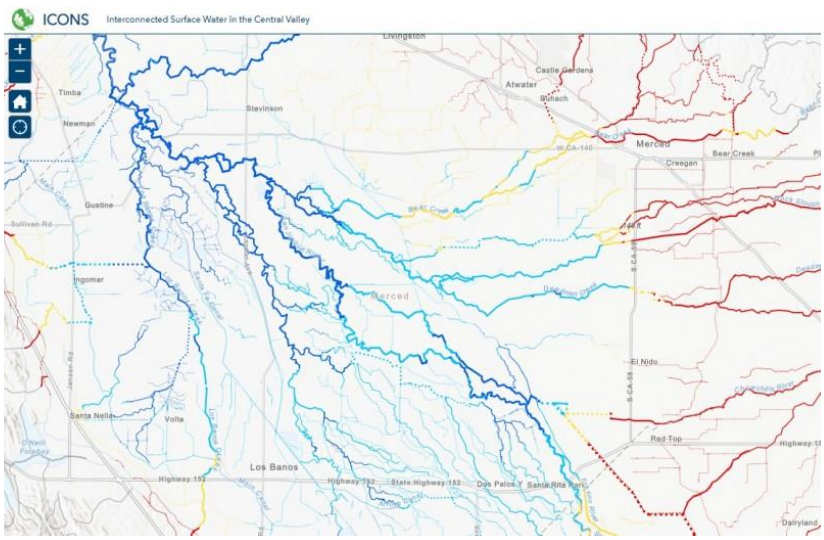
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the San Luis Rey Valley - Upper San Luis Rey Valley Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the San Luis Rey Valley - Upper San Luis Rey Valley Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Candidate - Threatened	Endangered	
Empidonax traillii extimus	Southwestern Willow Flycatcher	Endangered	Endangered	
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority
Plegadis chihi	White-faced Ibis		Watch list	
Setophaga petechia brewsteri	A Yellow Warbler	Bird of Conservation Concern	Special Concern	
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris clarkae	Clark's Marsh Wren		Special Concern	BSSC - Second priority
Cistothorus palustris palustris	Marsh Wren			
Egretta thula	Snowy Egret			
Fulica americana	American Coot			
Gallinula chloropus	Common Moorhen			
Gelochelidon nilotica vanrossemi	Gull-billed Tern	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Himantopus mexicanus	Black-necked Stilt			
Limnodromus scolopaceus	Long-billed Dowitcher			
Megaceryle alcyon	Belted Kingfisher			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			

Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa semipalmata	Willet			
Vireo bellii	Bell's Vireo			
#REF!				
Astacidae fam.	Astacidae fam.			
Cambaridae fam.	Cambaridae fam.			
Crangonyx spp.	Crangonyx spp.			
Cyprididae fam.	Cyprididae fam.			
Gammarus spp.	Gammarus spp.			
Hyalella spp.	Hyalella spp.			
Pacifastacus spp.	Pacifastacus spp.			
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern	ARSSC
Pseudacris cadaverina	California Treefrog			ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Thamnophis sirtalis ssp. 1	South Coast Gartersnake		Special Concern	ARSSC
BIRDS				
Ablabesmyia spp.	Ablabesmyia spp.			
Aeshna spp.	Aeshna spp.			
Agabus spp.	Agabus spp.			
Alotanypus spp.	Alotanypus spp.			
Ambrysus spp.	Ambrysus spp.			
Ampumixis dispar				Not on any status lists
Anacaena spp.	Anacaena spp.			
Anopheles spp.	Anopheles spp.			

Argia spp.	Argia spp.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Brillia spp.	Brillia spp.			
Centroptilum spp.	Centroptilum spp.			
Chaetarthria spp.	Chaetarthria spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corduliidae fam.	Corduliidae fam.			
Corisella decolor				Not on any status lists
Corisella inscripta				Not on any status lists
Corisella spp.	Corisella spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus bicinctus				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Culex spp.	Culex spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Endochironomus spp.	Endochironomus spp.			
Enochrus ochraceus				Not on any status lists
Enochrus piceus				Not on any status lists
Enochrus spp.	Enochrus spp.			
Ephydridae fam.	Ephydridae fam.			
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Graptocorixa spp.	Graptocorixa spp.			
Helochares normatus				Not on any status lists
Hetaerina americana	American Rubyspot			
Heterelmis obesa				Not on any status lists
Hydrophilidae fam.	Hydrophilidae fam.			
Hydroporus spp.	Hydroporus spp.			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Hydroscapha natans				Not on any status lists

Ischnura spp.	Ischnura spp.			
Laccobius spp.	Laccobius spp.			
Limnophyes spp.	Limnophyes spp.			
Microcylloepus spp.	Microcylloepus spp.			
Micropsectra spp.	Micropsectra spp.			
Mideopsis spp.	Mideopsis spp.			
Ochrotrichia spp.	Ochrotrichia spp.			
Ochthebius spp.	Ochthebius spp.			
Optioservus spp.	Optioservus spp.			
Oxyethira spp.	Oxyethira spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Peltodytes spp.	Peltodytes spp.			
Pentaneura spp.	Pentaneura spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			
Postelichus spp.	Postelichus spp.			
Procladius spp.	Procladius spp.			
Procloeon venosum	A Mayfly			
Protanyderus spp.	Protanyderus spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Psychodidae fam.	Psychodidae fam.			
Radotanypus spp.	Radotanypus spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Simuliidae fam.	Simuliidae fam.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sperchontidae fam.	Sperchontidae fam.			
Tanypus spp.	Tanypus spp.			
Tanytarsus spp.	Tanytarsus spp.			
Tipulidae fam.	Tipulidae fam.			
Tribelos spp.	Tribelos spp.			
Trichocorixa calva				Not on any status lists
Trichocorixa reticulata				Not on any status lists
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus spp.	Tropisternus spp.			
Zoniagrion exclamationis	Exclamation Damsel			
INSECTS & OTHER INVERTS				
Hydrobiidae fam.	Hydrobiidae fam.			
Lymnaea spp.	Lymnaea spp.			
Lymnaeidae fam.	Lymnaeidae fam.			
Physa spp.	Physa spp.			
PLANTS				
Brodiaea orcuttii	Orcutt's Brodiaea		Special	CRPR - 1B.1

Alnus rhombifolia	White Alder			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Baccharis salicina				Not on any status lists
Castilleja minor minor	Alkali Indian-paintbrush			
Castilleja minor spiralis	Large-flower Annual Indian-paintbrush			
Cyperus erythrorhizos	Red-root Flatsedge			
Datisca glomerata	Durango Root			
Eleocharis parishii	Parish's Spikerush			
Juncus dubius	Mariposa Rush			
Juncus effusus austrocalifornicus				Not on any status lists
Juncus effusus pacificus				
Juncus macrophyllus	Longleaf Rush			
Juncus rugulosus	Wrinkled Rush			
Juncus xiphioides	Iris-leaf Rush			
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus guttatus	Common Large Monkeyflower			
Mimulus pilosus				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Phragmites australis australis	Common Reed			
Platanus racemosa	California Sycamore			
Pluchea odorata odorata	Scented Conyza			
Pluchea sericea	Arrow-weed			
Populus trichocarpa	NA			Not on any status lists
Rumex conglomeratus	NA			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Samolus parviflorus	NA			Not on any status lists
Schoenoplectus californicus	California Bulrush			
Stachys ajugoides	Bugle Hedge-nettle			
Veronica anagallis-aquatica	NA			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

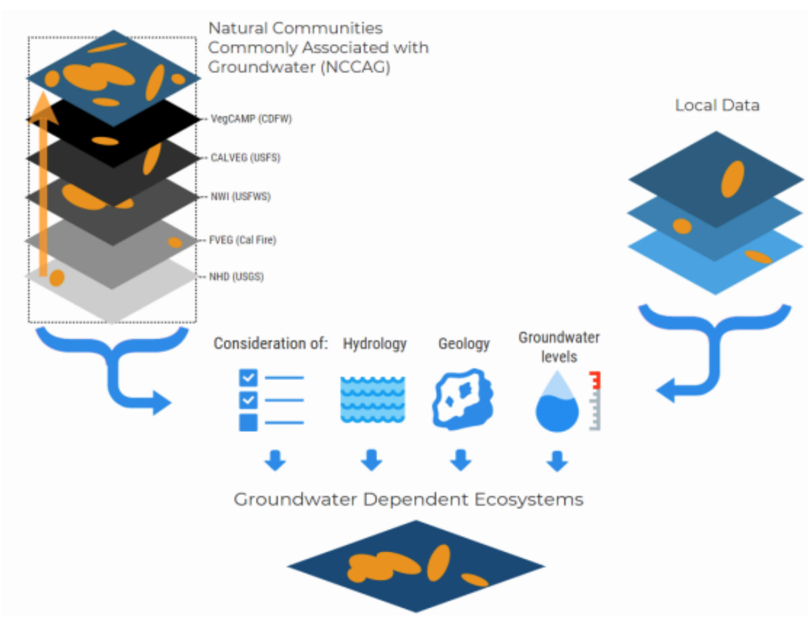


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

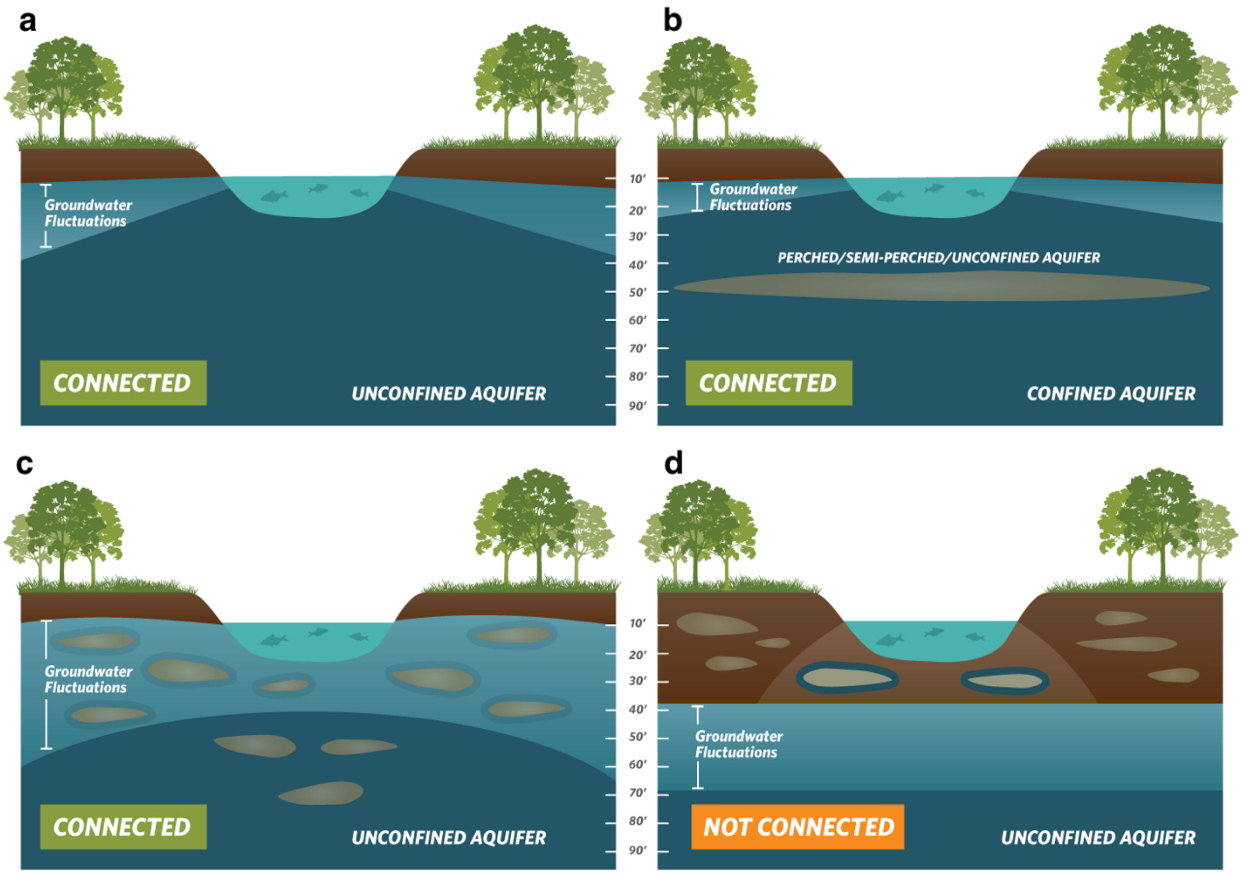

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

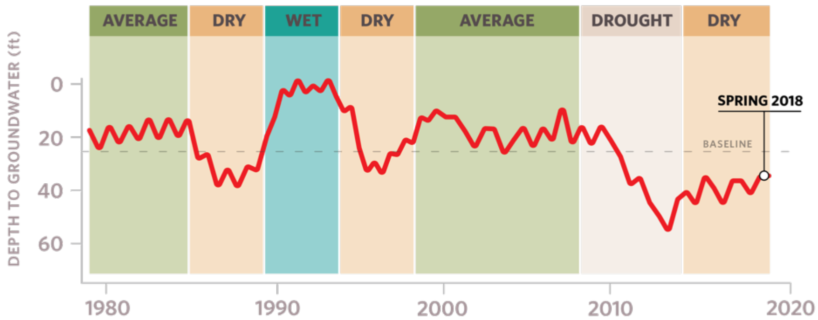

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

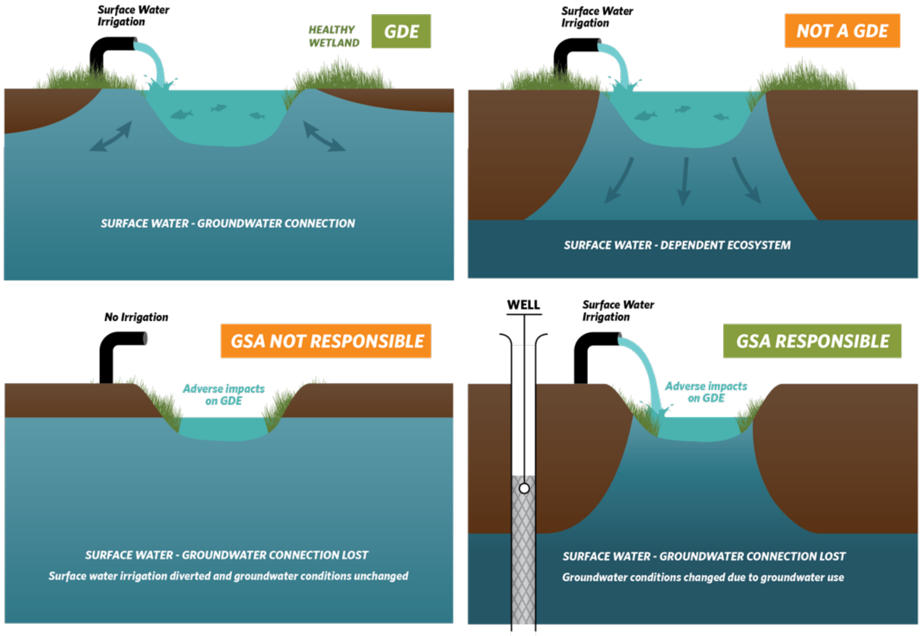

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

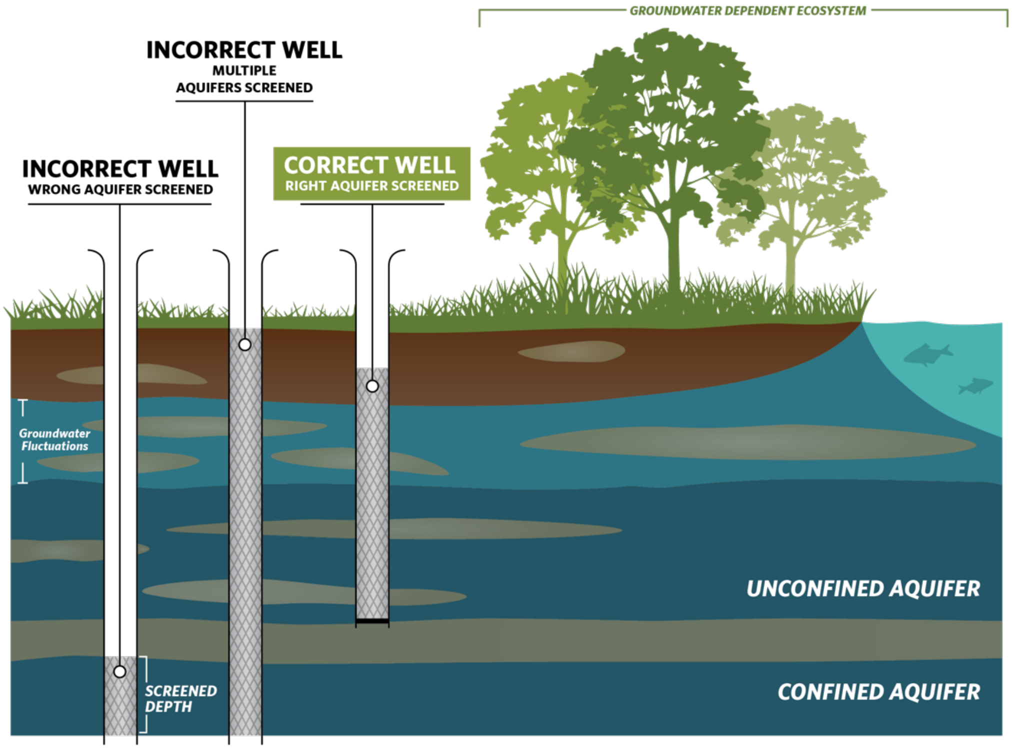

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

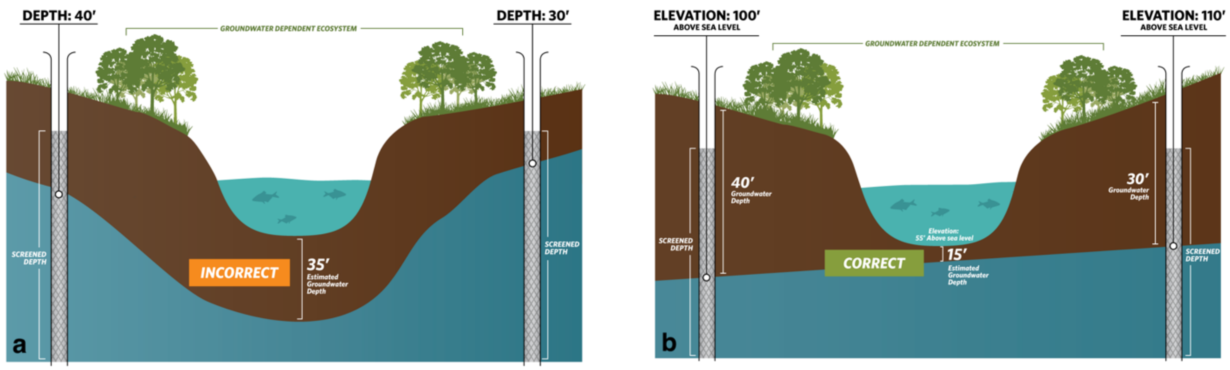

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

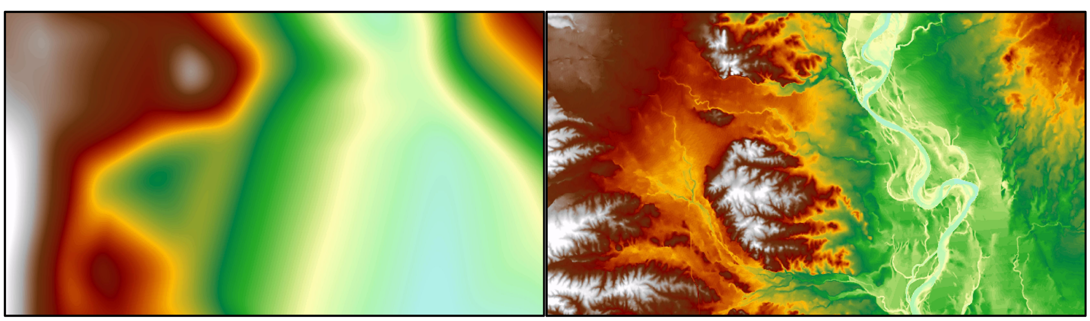

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

October 15, 2021

Salinas Valley Basin GSA
P.O. Box 1350
Carmel Valley, CA 93924

Submitted via web: https://form.jotform.com/201537036733047

Re: Public Comment Letter for Upper Valley Aquifer Subbasin Draft GSP

Dear Donna Meyers,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Upper Valley Aquifer Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Upper Valley Aquifer Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

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Local Government Commission

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Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Heather Lukacs, Ph.D.
Director of Community Solutions
Community Water Center

Justine Massey
Policy Manager and Attorney
Community Water Center

Attachment A

Specific Comments on the Upper Valley Aquifer Subbasin Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP provides information on DACs, including identification by name and location on a map (Figure 2-3), and identifying the water source for DAC members. However, the GSP fails to identify the population of each identified DAC.

The GSP provides a density map of domestic wells in the subbasin. However, the GSP fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS
• Include a map showing domestic well locations and average well depth across the subbasin. • Provide the population of each identified DAC.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **insufficient**, due to lack of supporting information provided for the ISW analysis. To assess ISWs, the GSP used the Salinas Valley Integrated Hydrologic Model (SVIHM). The GSP states (p. 4-25): *"Although seepage along the ISW reaches is based on assumed channel and aquifer parameters as model inputs, the preliminary SVIHM is the best available tool to estimate ISW locations. The model construction and uncertainty are described in Chapter 6 of this GSP."* However, Chapter 6 of the GSP, the water budget chapter, presents very little information on the model. No further information in the GSP was presented providing description of the location of groundwater wells or stream gauges used in the analysis, or description of temporal (seasonal and interannual) variability of the data used to calibrate the model.

The GSP states (p. 4-25): *"The blue cells [in Figure 4-11] indicate areas where surface water is connected to groundwater for more than 50 percent of the number of months in the model period and are designated as areas of ISW. The clear cells represent areas that have interconnection less than 50 percent of the model period and require further evaluation to determine whether the SMC, discussed in Chapter 8, apply."* Note the regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

RECOMMENDATIONS

- Describe available groundwater elevation data and stream flow data in the subbasin. ISWs are best analyzed using depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought), to determine the range of depth and capture the variability in environmental conditions inherent in California's climate.
- Overlay the stream reaches shown on Figure 4-11 with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells in the subbasin used to create the contour maps.
- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.
- On Figure 4-11 (Locations of Interconnected Surface Water), consider any modelled stream grid cells with >0% connection to groundwater as potential ISWs until more data is available. In other words, consider any stream cell with connection to groundwater for any length of time as a potential ISW.
- Describe data gaps for the ISW analysis. Reconcile these data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of comprehensive, systematic analysis of the subbasin's GDEs.

The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources. The GSP does not discuss how the NC dataset was verified with the use of groundwater data, however. The GSP states (p. 4-29): *"The SVBGSA reviewed the NCCAG dataset and assessed each GDE's potential connection to groundwater by determining if the GDE was underlain by shallow groundwater that has been delineated as being part of a Bulletin 118 principal aquifer, and if depth to groundwater is less than 30 feet."* However, no further details are provided in the GSP. Based on the description provided in the GSP, it is unclear if Figure 4-12 (Groundwater Dependent Ecosystems) presents the entire NC dataset, or further analysis based on the 30 feet threshold as described in the text. Without an analysis of groundwater data to verify the NC dataset polygons, it will be difficult or impossible to adequately monitor and manage the subbasin's GDEs throughout GSP implementation.

We commend the GSA for listing the threatened and endangered species likely to depend on groundwater, as determined from several sources including the US Fish and Wildlife Service (USFWS) website, California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDB), and TNC Critical Species LookBook (Table 4-1). Vegetation species present in the subbasin's potential GDEs were not included in the GSP, however.

RECOMMENDATIONS

- Develop and describe a systematic approach for analyzing the subbasin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained, removed, or added to/from the NC dataset (include the removal reason if polygons are not considered potential GDEs, or include the data source if polygons are added). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as valley oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- Please provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin (see Attachment C of this letter for a list of freshwater species located in the Upper Valley Subbasin).

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included in the water budget. The integration of native vegetation into the water budget is **insufficient**. The water budget includes a separate item for evapotranspiration, but based on the text it is unclear whether the values shown in the budget tables apply to riparian evapotranspiration only or contain crop evapotranspiration as well. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. The GSP states that managed wetlands are not present in the subbasin.

RECOMMENDATION

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **incomplete**. SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the Communication and Public Engagement section of the GSP (Chapter 2).

The GSA's outreach activities include conducting interviews with DAC community leaders to identify strategies to work together during GSP planning and implementation; conducting workshops with partners on water and groundwater sustainability; identifying concerns from DACs and underrepresented communities; planning listening sessions around GSA milestones; developing a resource hub with partner organizations; identifying community allies to partner with in reducing barriers to participation from DACs; and planning to convene a working group on domestic water that includes DACs and underrepresented communities. However, there is no specific pathway for feedback from DAC residents and representatives to be considered and included in the GSP and its implementation.

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[1] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[2] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[3] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

We note additional deficiencies with the overall stakeholder engagement process. While environmental organizations have a representative serving on the board of directors and are listed as stakeholders and as members of the GSP Advisory Committee, there is no specific outreach described that is directly targeted to environmental stakeholders during the GSP development and implementation processes.

RECOMMENDATIONS

- In the Communication and Public Engagement Plan, describe active and targeted outreach to engage environmental stakeholders during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- DAC and environmental stakeholder engagement should be improved by incorporating feedback and recommendations from DAC and environmental stakeholders engaged in the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[4] and establishing minimum thresholds.[5,6]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP discusses minimum thresholds impact on domestic wells (Section 8.6.2.2). Unlike other GSPs for Salinas Valley subbasin, the GSP does not analyze the impact on domestic wells due to lack of data. The GSP states (p. 8-13): *"In the Upper Valley, only 4 of the 145 domestic wells from the OSWCR database had accurate locations. Without an accurate location, whether a well would be negatively impacted when groundwater elevations are at the minimum threshold cannot be determined."* The GSP states (p. 8-7): *"The minimum thresholds for chronic lowering of groundwater levels are set to 5 feet below the lowest groundwater elevation between 2012 and 2016 at each representative monitoring well."* The GSP does not describe or analyze the impact on DACs and domestic well owners to minimum thresholds that are set to levels even lower than drought-level groundwater elevations.

Section 8.6.4 defines undesirable results for the chronic lowering of groundwater level SMC. The GSP states (p. 8-19): *"The chronic lowering of groundwater levels undesirable result is: more than 15% of the groundwater elevation minimum thresholds are exceeded."* However, undesirable results should inform the development of minimum thresholds, not the other way around. The

4 "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
5 "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
6 "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

GSP should establish minimum thresholds at the representative monitoring wells that account for the specific undesirable results the GSA has determined for the subbasin.

For degraded water quality, the GSP identifies constituents of concern (COCs) within the subbasin. The GSP states (p. 5-20): *"The SVBGSA does not have regulatory authority over groundwater quality and is not charged with improving groundwater quality in the Salinas Valley Groundwater Basin."* Table 8-4 provides a list of constituents and number of wells that must exceed regulatory standards in order to trigger minimum thresholds but fails to provide justification for how those numbers were selected. The GSP also sets measurable objectives identical to minimum thresholds; the exceedance of minimum thresholds is supposed to trigger additional actions but since minimum thresholds in this plan are identified as measurable objectives, it is unclear what action is triggered. Furthermore, the regulatory standards are not explicitly provided in the GSP.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for chronic lowering of groundwater levels. For the analysis of minimum threshold impact on domestic wells, use best available information such as Public Land Survey System (PLSS) section location data.
- Establish minimum thresholds at the representative monitoring wells that account for the specific undesirable results the GSA would like to avoid.

Degraded Water Quality

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[7]
- Set measurable objectives at lower levels than minimum thresholds (i.e., indicative of better water quality).
- Set concentration-based minimum thresholds and measurable objectives for COCs in the subbasin that are impacted by groundwater use and/or management. Ensure they align with drinking water standards[8].
- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users.

[7] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[8] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts to GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC.

Sustainable management criteria for depletion of interconnected surface water are established by proxy using shallow groundwater elevations observed in 2016 near locations of interconnected surface water. To describe impacts to ecological surface water users, the GSP states (p. 8-42): *"Review of MCWRA's Nacimiento Dam Operation Policy and MCWRA's water rights indicates MCWRA operates the Dam in a manner that meets downstream demands and considers ecological surface water users. Since the reservoir operations consider ecological surface water users and reflect reasonable existing surface water depletion rates, this GSP infers that stream depletion from existing groundwater pumping is not unreasonable."* The GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[9] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[10] can be determined.

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached[11]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left

[9] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[10] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[11] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,12].

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[13] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the GSP does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

We acknowledge and commend the inclusion of climate change into key inputs (e.g., precipitation, evapotranspiration, surface water flow, and sea level) of the projected water budget. However, the GSP does not calculate a sustainable yield based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

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[12] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[13] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent shallow groundwater elevations and water quality conditions around DACs and domestic wells in the subbasin.

Figure 7-2 (Upper Valley Aquifer Representative Monitoring Network for Groundwater Levels) and Figure 7-4 (Locations of DDW Public Water System Supply Wells in the Groundwater Quality Monitoring Network) show that no monitoring wells are located across portions of the subbasin near DACs and domestic wells. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[14].

The GSP provides discussion of data gaps for GDEs and ISWs in Section 7.6.2 (Interconnected Surface Water Data Gaps) and Section 10.1.2 (Improving Monitoring Networks) of the GSP. The GSP could be improved by describing biological monitoring that could be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

RECOMMENDATIONS
• Provide maps that overlay monitoring well locations with the locations of DACs and domestic wells to clearly identify potentially impacted areas. Increase the number of representative monitoring sites (RMSs) in the shallow aquifer across the subbasin for the groundwater elevation and groundwater quality condition indicators. Prioritize proximity to DACs and drinking water users when identifying new RMSs. • Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin. • Ensure groundwater elevation and water quality RMSs are tracking groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, GDEs, and ISWs. Groundwater elevation and quality RMS data gaps (spatial and depth) in relation to key beneficial users in the subbasin are provided in Attachment E.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these

[14] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

In Section 9.6.3 (Implementation Action C3: Dry Well Notification System), the GSP states (p. 9-42): *"The GSA could develop or support the development of a program to assist well owners (domestic or state small and local small water systems) whose wells go dry due to declining groundwater elevations."* The GSP states that the program could involve a notification system, monitoring triggered by lowered groundwater elevations, public outreach, *"...referral to assistance with short-term supply solutions, technical assistance to assess why it went dry, and/or long-term supply solutions."* No further specifics on a drinking water well impact mitigation program are provided, however.

RECOMMENDATIONS

- For DACs and domestic well owners, provide specific plans for implementation of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[15].

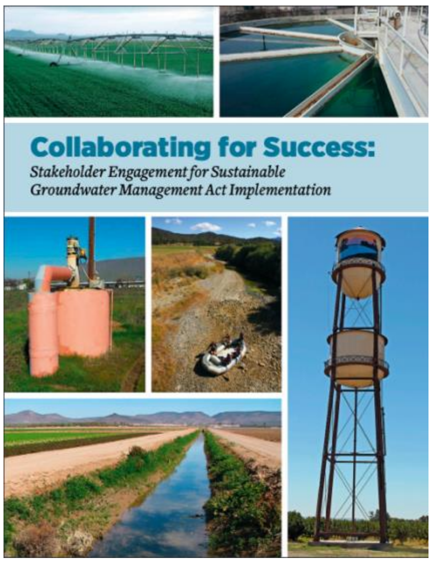
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[15] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



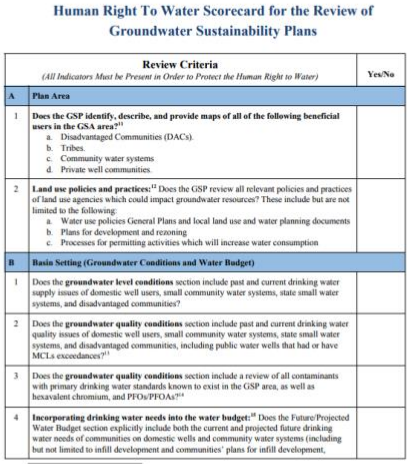
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

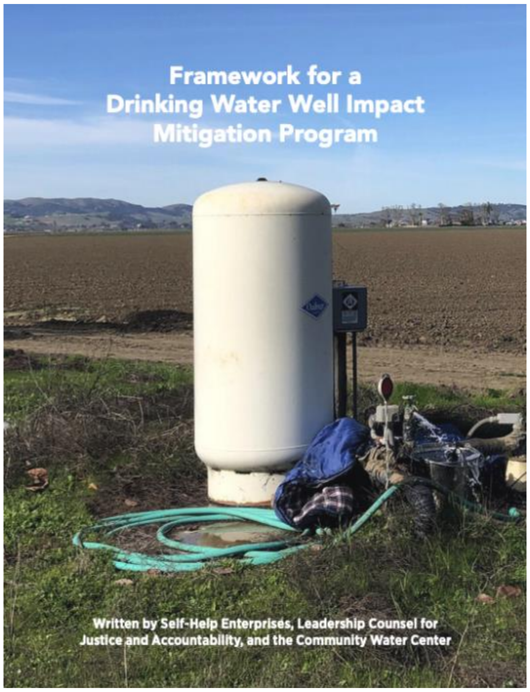


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

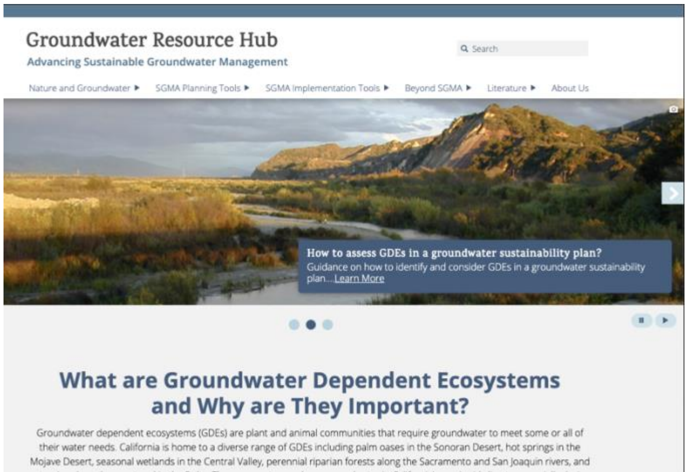
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



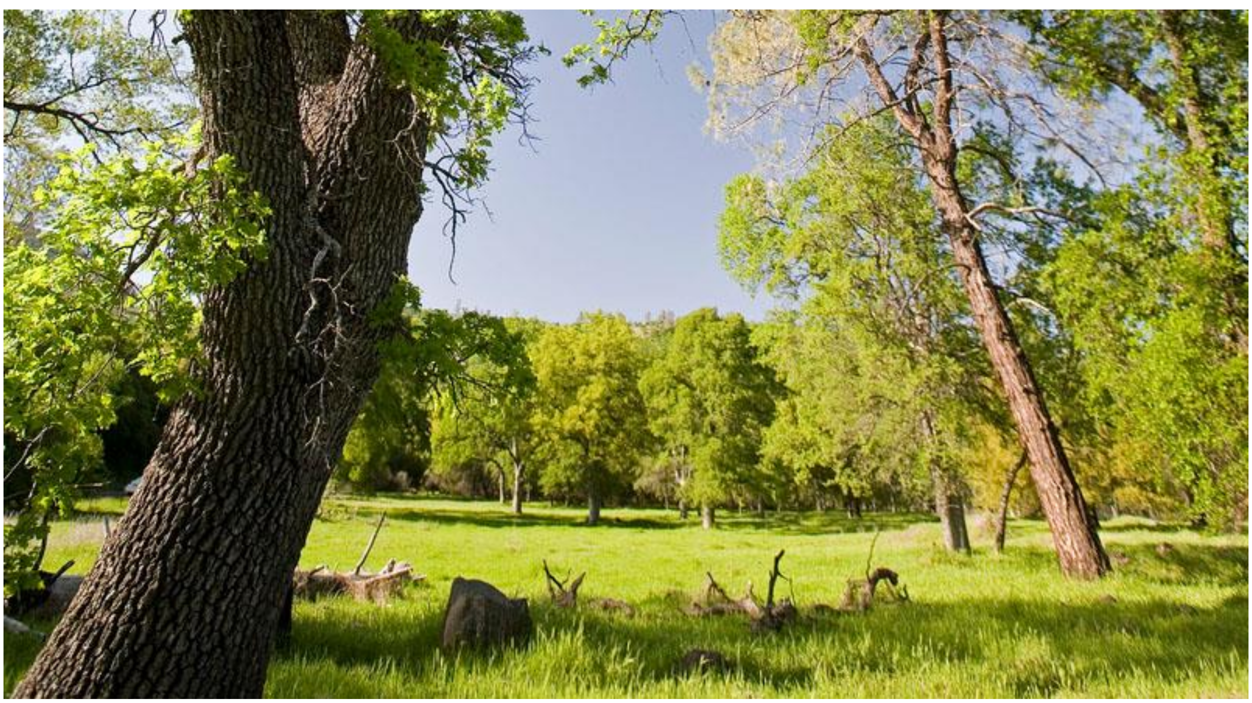
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

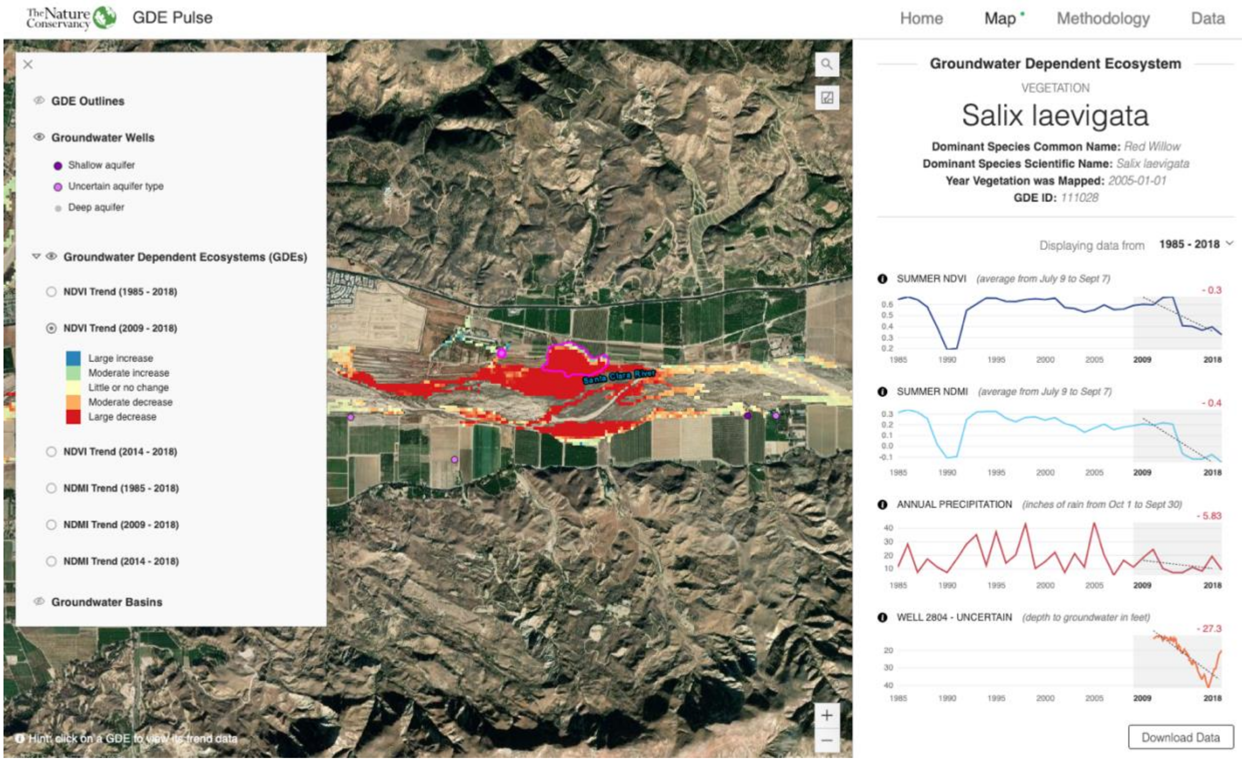
1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

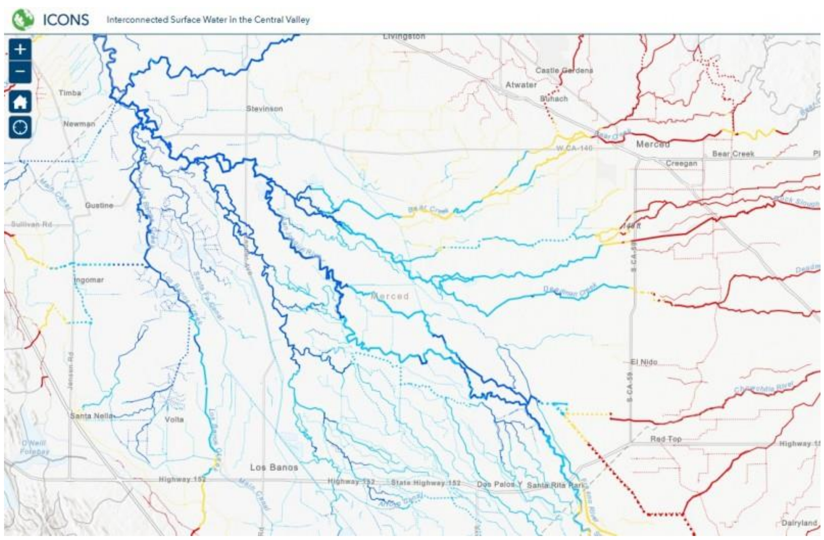
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Upper Valley Aquifer Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Upper Valley Aquifer Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	**State**	**Other**
BIRDS				
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya collaris	Ring-necked Duck			
Aythya valisineria	Canvasback		Special	
Bucephala albeola	Bufflehead			
Calidris alpina	Dunlin			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Cistothorus palustris palustris	Marsh Wren			
Gallinago delicata	Wilson's Snipe			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Oxyura jamaicensis	Ruddy Duck			
Phalacrocorax auritus	Double-crested Cormorant			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Rallus limicola	Virginia Rail			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Cyprididae fam.	Cyprididae fam.			
Hyalella spp.	Hyalella spp.			
FISH				
Oncorhynchus mykiss - SCCC	South Central California coast steelhead	Threatened	Special Concern	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC

Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Pseudacris regilla	Northern Pacific Chorus Frog			
INSECTS & OTHER INVERTS				
Acentrella insignificans	A Mayfly			
Acentrella spp.	Acentrella spp.			
Agabus spp.	Agabus spp.			
Ambrysus mormon				Not on any status lists
Baetidae fam.	Baetidae fam.			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Berosus spp.	Berosus spp.			
Centroptilum spp.	Centroptilum spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Enochrus spp.	Enochrus spp.			
Ephydridae fam.	Ephydridae fam.			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Gyrinidae fam.	Gyrinidae fam.			
Helophorus spp.	Helophorus spp.			
Hetaerina americana	American Rubyspot			
Hydrophilidae fam.	Hydrophilidae fam.			
Hydroporus spp.	Hydroporus spp.			
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila spp.	Hydroptila spp.			
Hydryphantidae fam.	Hydryphantidae fam.			
Laccophilus maculosus				Not on any status lists
Laccophilus pictus				Not on any status lists
Leptoceridae fam.	Leptoceridae fam.			
Nectopsyche spp.	Nectopsyche spp.			
Optioservus spp.	Optioservus spp.			
Paracloeodes minutus	A Small Minnow Mayfly			
Paratanytarsus spp.	Paratanytarsus spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			

Sigara spp.	Sigara spp.			
Simuliidae fam.	Simuliidae fam.			
Simulium spp.	Simulium spp.			
Sperchontidae fam.	Sperchontidae fam.			
Tanytarsus spp.	Tanytarsus spp.			
Tipulidae fam.	Tipulidae fam.			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus spp.	Tropisternus spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
MOLLUSKS				
Ferrissia spp.	Ferrissia spp.			
PLANTS				
Veronica anagallis-aquatica	NA			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

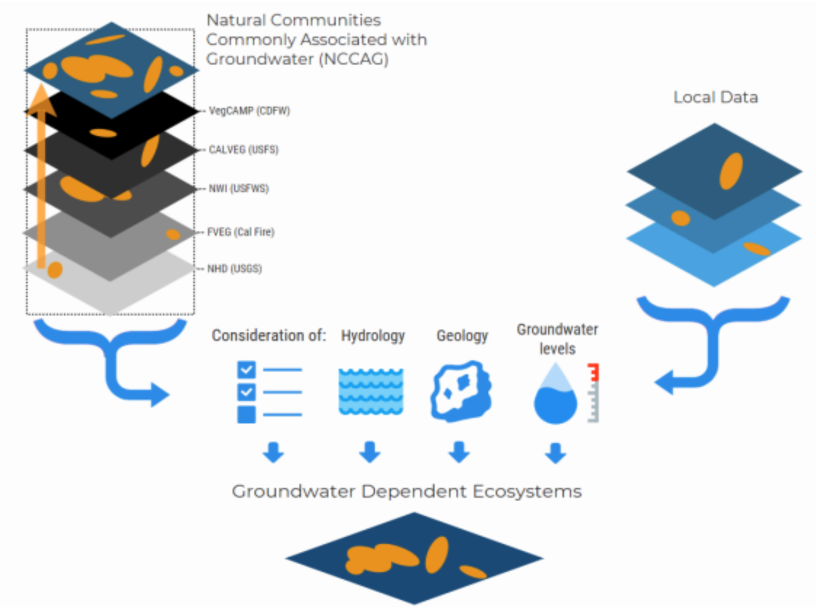


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

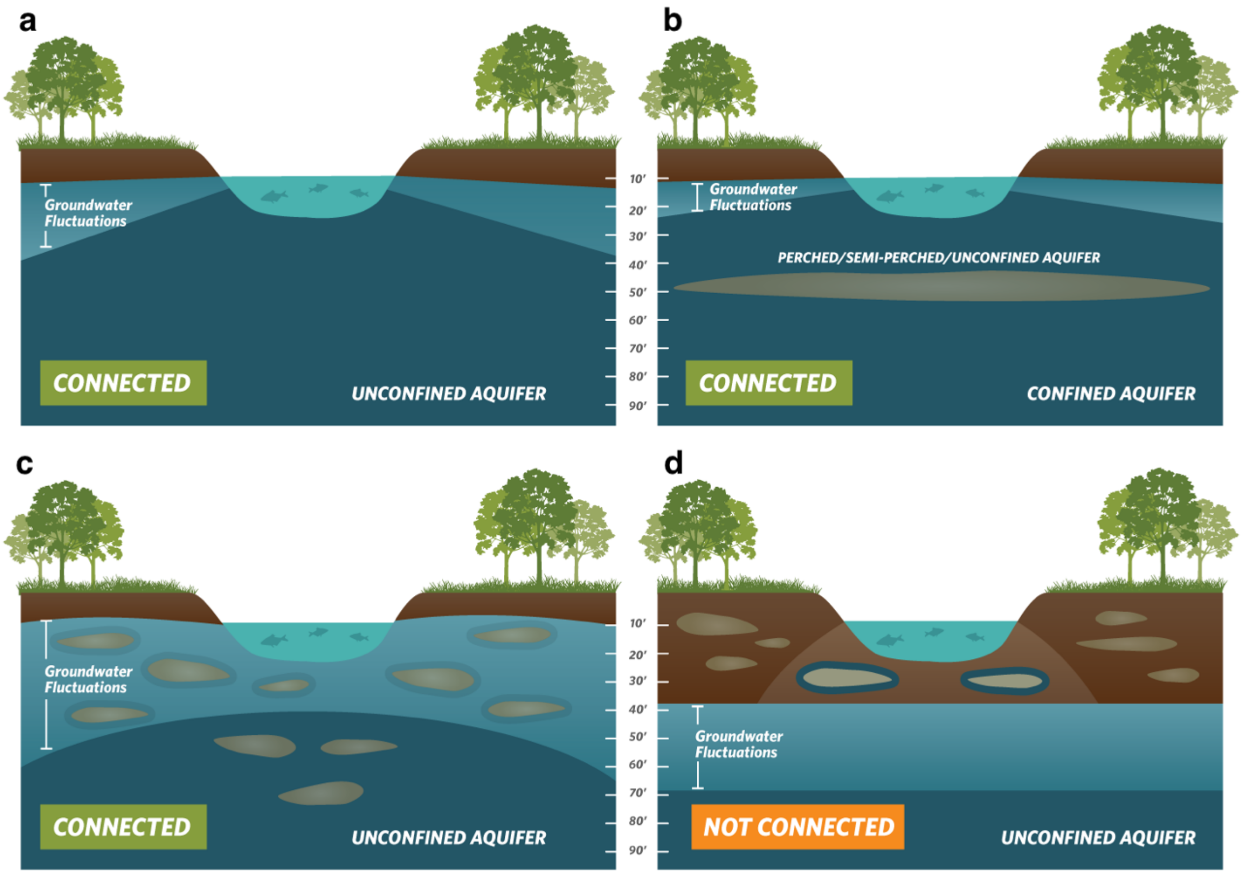

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

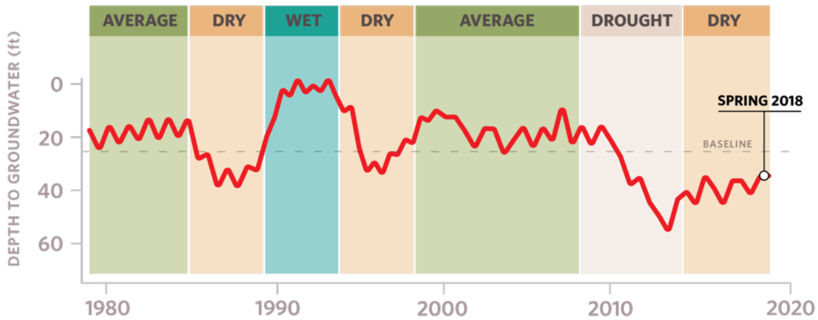

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

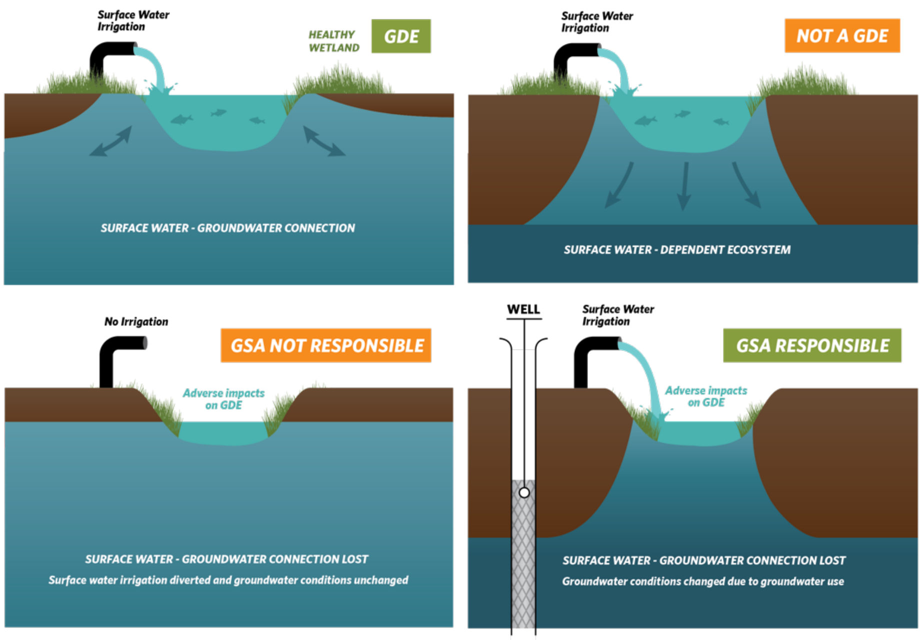

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

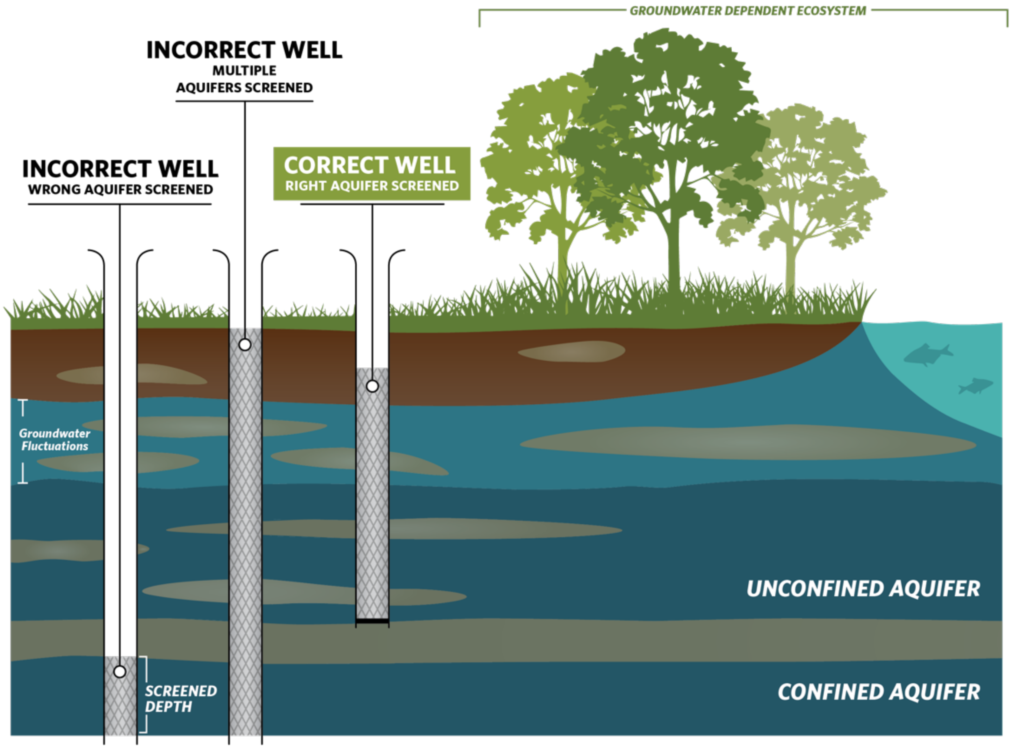

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

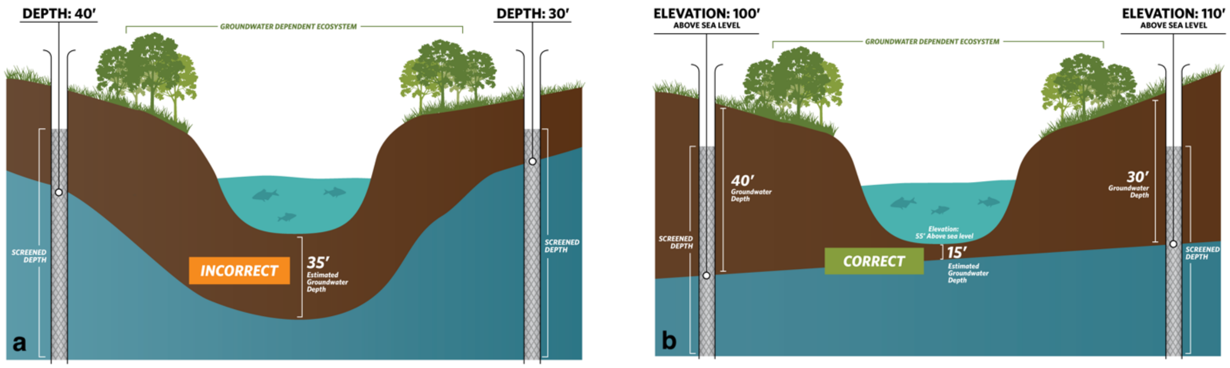

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

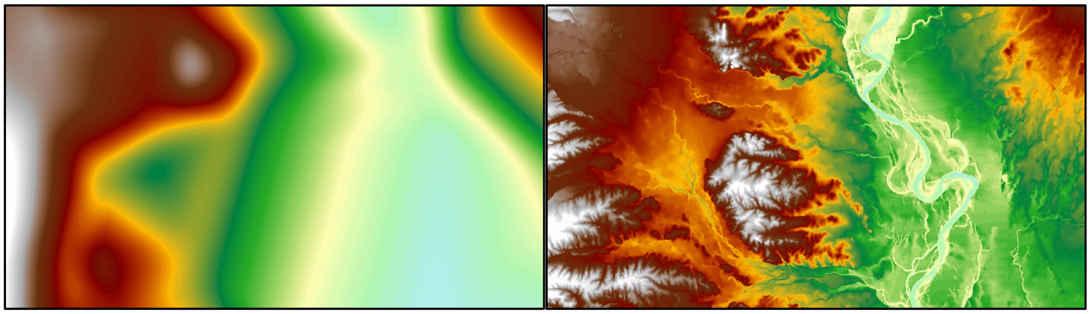

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

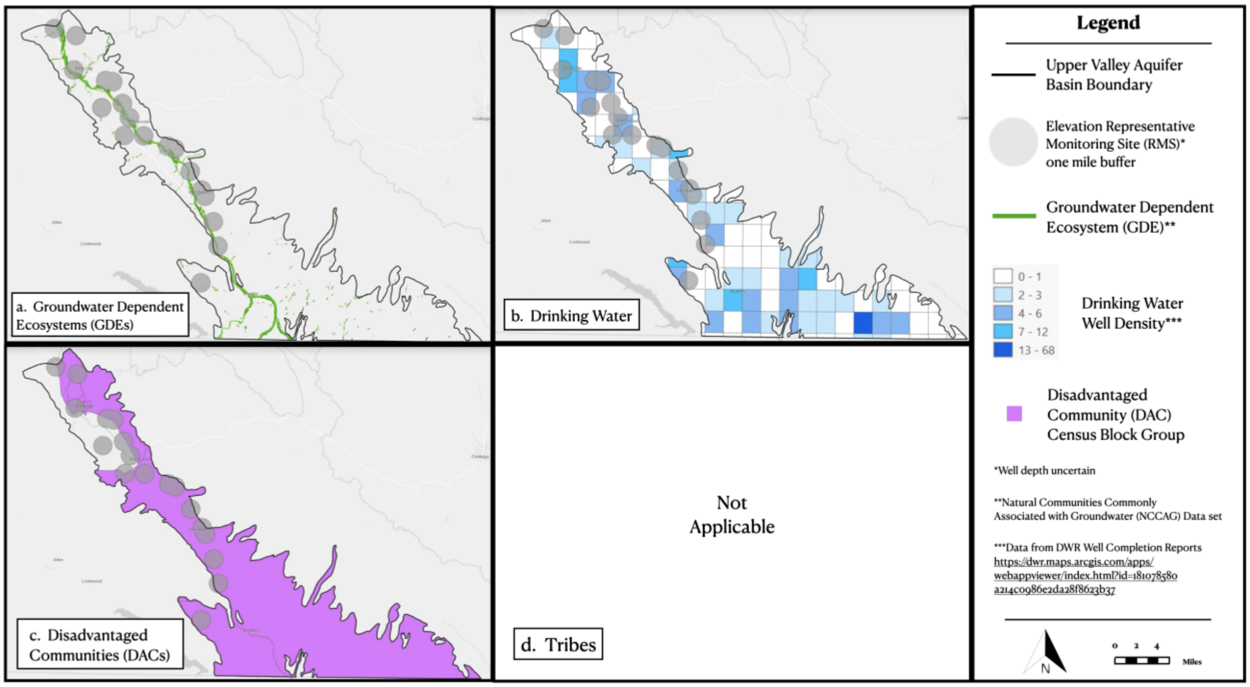

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

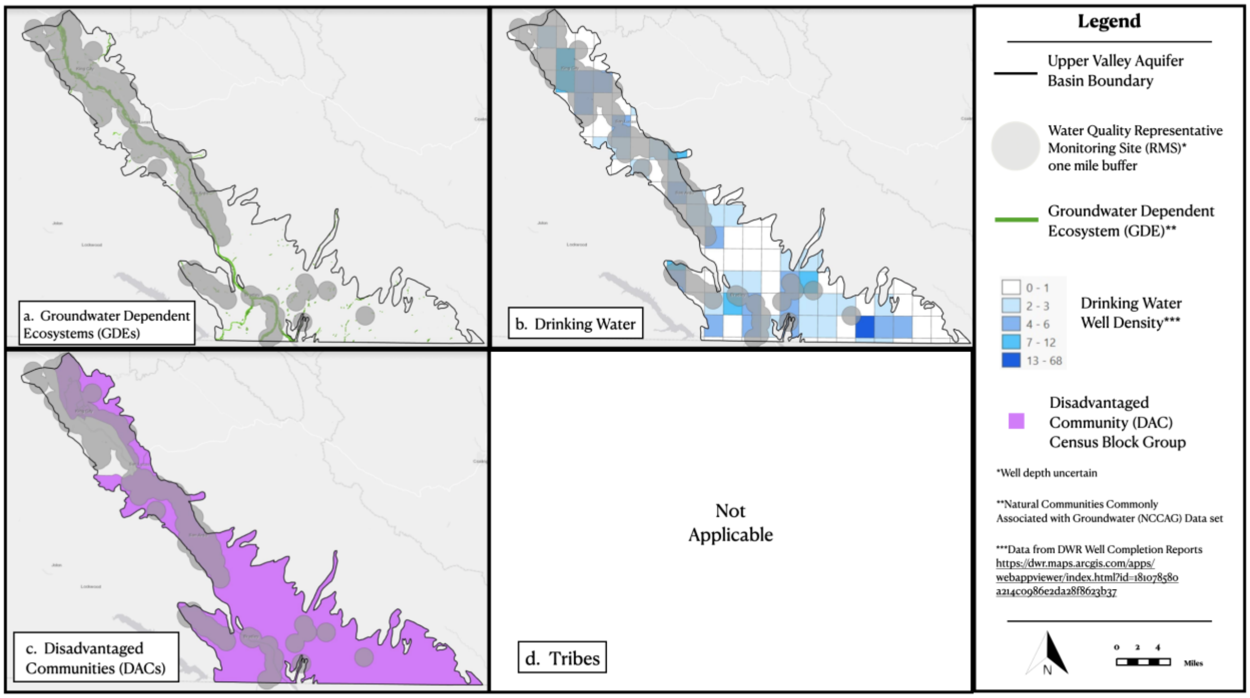

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

October 8, 2021

Upper Ventura River Groundwater Agency
Meiners Oaks Water District
202 W. El Roblar Dr.
Ojai, CA 93023

Submitted via email: bbondy@uvrgroundwater.org

Re: Public Comment Letter for Upper Ventura River Valley Basin Draft GSP

Dear Bryan Bondy,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Upper Ventura River Valley Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.

2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Upper Ventura River Valley Basin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring points in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Upper Ventura River Valley Basin Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. We note the following deficiencies with the identification of these key beneficial users.

- The GSP identifies the community of Casitas Springs as a DAC. The GSP, however, does not show the DAC boundaries on a map or provide the population of the DAC area.
- Appendix E includes the Barbareño-Ventureño Band of Mission Indians as part of the GSA's interested parties list and states that "portions of the Barbareño-Ventureño Band of Mission Indians are located within the UVR Basin." A map of these lands, however, is not provided.
- The GSP fails to provide a density map or location map of domestic wells and their depths (such as minimum well depth, average well depth, or depth range) within the basin.
- The GSP fails to identify the population dependent on groundwater as their source of drinking water in the basin. Specifics are not provided on how much the DAC community relies on a particular water supply (e.g., what percentage is supplied by groundwater).

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS
• Provide a map of the boundaries of the recognized DAC in the basin. Provide the population of the DAC. • Provide a map of tribal lands within the basin. • Include a map showing domestic well locations and average well depth across the basin. • Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. Based on the ISW section of the GSP (Section 3.2.6) and UVRGB Numerical Model documentation (Appendix H), it appears that a comprehensive analysis of ISWs in the basin was performed. The ISW section of the GSP lacked a clear summary of the locations of groundwater wells and their screen depths used in the analysis, and description of temporal (seasonal and interannual) variability of the data used to calibrate the model. This information should be provided in the GSP to support the conclusions presented.

Figure 3.2-11 (Surface Water Bodies – Hydrologic Conditions) labels sections of the Ventura River as: (1) Losing Reach with Intermittent Groundwater- Surface Water Interconnection, (2) Losing Reach with Generally Disconnected Groundwater- Surface Water, (3) Variably Losing or Gaining Reach with Intermittent Groundwater- Surface Water Interconnection, and (4) Gaining Reach with Generally Interconnected Groundwater - Surface Water. We recommend that these labels are clarified in the text so it is more clear which stream segments are retained as ISWs or potential ISWs in the GSP.

RECOMMENDATIONS
● Describe the legend labels used on Figure 3.2-11 in the GSP text to make clear which stream segments are retained as ISWs or potential ISWs in the GSP. ● Further describe the groundwater elevation data and stream flow data used in the ISW analysis. Ensure depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) are used to determine the range of depth and capture the variability in environmental conditions inherent in California's climate. ● Overlay the stream reaches shown on Figure 3.2-11 with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis. ● For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. ● Describe data gaps for the ISW analysis in the ISW section, in addition to the discussion in Sections 3.1.4 (Data Gaps and Uncertainty). On Figure 3.2-11, include reaches with data gaps as potential ISWs.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources. However, we found that mapped features in the NC dataset were improperly disregarded, as described below.

- NC dataset polygons were incorrectly removed based on the assumption that they are supported by the shallow, perched water table. However, shallow aquifers that have the potential to support well development, support ecosystems, or provide baseflow to streams are principal aquifers[1], even if the majority of the basin's pumping is occurring in deeper principal aquifers. If there are no data to characterize groundwater conditions in the shallow principal aquifer, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP.
- NC dataset polygons were incorrectly removed in areas adjacent to irrigated fields due to the presence of surface water. However, this removal criteria is flawed since GDEs, in addition to groundwater, can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields – simultaneously and at different temporal/spatial scales. NC dataset polygons adjacent to irrigated land can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to irrigated fields.

We commend the GSA for using depth-to-groundwater data from multiple seasons and water year types to determine the range of depth to groundwater for the GDE analysis. The GSP states that water years 2005, 2010, and 2015 were selected to represent wet, average, and dry precipitation conditions, respectively. We also commend the GSA for including the complete inventory of flora and fauna species and habitat types in the basin's GDEs. Appendices O and P include figures, tables, and descriptions of flora and fauna and a list of special status species with potential to occur in the Upper Ventura River Valley Basin.

RECOMMENDATIONS
• Describe a systematic approach for analyzing the basin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained, removed, or added to/from the NC dataset (include the removal reason if polygons are not considered potential GDEs, or include the data source if polygons are added). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. • Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as valley oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources. • Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape.

[1] "'Principal aquifers' refer to aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems." [23 CCR §351(aa)]

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[2,3] to be included in the water budget. The integration of native vegetation into the water budget is **sufficient**. We commend the GSA for including the groundwater demands of this ecosystem in the historical, current and projected water budgets. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATION

- State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Stakeholder Engagement Plan of the GSP (Appendix E).

The GSP describes outreach to DAC members and environmental stakeholders in the basin. Outreach to these members includes representation of DAC and environmental stakeholders on the GSA's Board of Directors, reserving seats on the Stakeholder Advisory Committee for domestic well owners, newsletters and emails to the interested parties list, social media posts, telephone communications with stakeholders, updates given to the Ventura River Watershed Council, public notices, newspaper articles, and direct outreach to DAC members of the Casitas Springs community. An Ad Hoc Stakeholder Engagement Committee was also formed throughout the GSP process to actively seek input across stakeholders. However, we note the following deficiency with the overall stakeholder engagement process. While tribal stakeholders are mentioned, there is no documentation of tribal consultation to ensure participation in GSP development and implementation processes.

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[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

RECOMMENDATION
• In the Stakeholder Engagement Plan, describe active and targeted consultation with tribal governments within the basin during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for guidance on how to consult with tribal governments.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[4] and establishing minimum thresholds[5,6]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP mentions impacts to drinking water users when defining undesirable results. The GSP does not, however, analyze direct and indirect impacts on DACs or tribes when defining undesirable results, or evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

The GSP starts the degraded water quality SMC section of the GSP with the statement (p. 112): "Significant changes to the degraded water quality SMC are expected before GSP Adoption." The GSP identifies constituents of concern (COCs) in the basin as the following: nitrate, TDS, sulfate, chloride, and boron. The GSP states (p. 116): "The minimum thresholds [Table 4.7-01] were selected be consistent with protection of human health (MCL for nitrate), the Upper Consumer Acceptance Levels (TDS and sulfate), and concentrations that are considered to represent toxicity thresholds for agricultural beneficial uses (chloride and boron)."

The GSP only includes a very general discussion of impacts to drinking water users when defining undesirable results and evaluating the cumulative or indirect impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs or tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

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[4] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
[5] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[6] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when describing undesirable results for chronic lowering of groundwater levels.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs, drinking water users, and tribes within the basin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.

Degraded Water Quality

- Provide an updated Section 4.7 (Degraded Water Quality) for public comment before GSP adoption.

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[7]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs, drinking water users, and tribes.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

For the chronic lowering of groundwater level SMC, the GSP states (p. 99): "Details concerning the analysis are provided in the Draft Riparian GDE Assessment Memo (Appendix O). In summary, it was concluded that riparian plant communities have experienced stress during periods of low groundwater levels historically, such as the 2012-2016 drought. However, the available data show that the riparian GDEs rebound following drought periods without a noticeable change in the predominant plant species. It was concluded that if groundwater levels were to remain chronically low for an extended period (beyond that seen in the historic dataset), pumping within the basin could exacerbate the stress on these communities and could potentially cause permanent or prolonged impacts to the riparian GDEs, which may be significant and unreasonable." The GSP sets the minimum thresholds to the historical low groundwater levels at the representative groundwater level monitoring sites. The GSP states (p. 102): "Modeling projections for the GSP suggest that the proposed minimum thresholds may be occasionally exceeded at some monitoring locations (Appendix Q). However, the criterion for undesirable results is not predicted to be triggered during the 50-year GSP implementation period." Despite acknowledging the impacts of drought-level groundwater elevations on GDEs, the GSP appears to disregard these impacts when setting the minimum thresholds to the historical low groundwater levels at the representative monitoring sites.

Two aquatic habitat areas were identified for consideration in the development of depletion of interconnected surface water SMC, Confluence Aquatic Habitat Area and Foster Park Aquatic Habitat Area. The GSP states (p. 131): "[T]here is insufficient information to assess whether depletion effects in the Confluence Aquatic Habitat Area are significant and unreasonable. SMC for the Confluence Aquatic Habitat Area cannot not be evaluated until these data gaps have been

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[7] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

addressed. The Confluence Aquatic Habitat Area will be revisited prior to the first five-year GSP assessment after addressing the data gaps." However, preliminary SMC should be established now (instead of at the five-year update) using the best available science to avoid significant and unreasonable effects on surface water beneficial users in the basin.

RECOMMENDATIONS
● Reevaluate the minimum thresholds for impacts to GDEs for the chronic lowering of groundwater level SMC. Set minimum thresholds to levels that avoid 'significant and unreasonable' effects on beneficial users. Potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[8] in the basin. Defining undesirable results is the crucial first step before the minimum thresholds[9] can be determined. ● Establish preliminary SMC for depletion of interconnected surface water for the Confluence Aquatic Habitat Area, instead of waiting for the five-year GSP update.

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[10] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the GSP does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

We acknowledge and commend the inclusion of climate change into key inputs (e.g., precipitation, evaporation, and surface water flow) of the projected water budget. The sustainable yield is calculated based on the projected pumping with climate change incorporated. However, If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

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[8] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[9] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[10] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

RECOMMENDATIONS
● Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions. ● Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent groundwater quality around DACs and domestic wells in the basin.

The GSP states (p. 161): "No representative monitoring sites have been identified for the degraded water quality sustainability indicator. However, it is noted for clarification that four well groups have been established to address the four sets of closely spaced wells in the groundwater quality monitoring network (Table 5.6-01 and Figure 5.6-01). These sets of closely spaced wells are grouped (i.e., treated as a single well) for the purposes of implementing the measurable objectives and minimum thresholds for the degraded water quality sustainability indicator, as discussed in Section 4.7.1." The GSP does not explain how the use of a well group to represent a RMS will satisfy the reporting requirements of SGMA, however.

Figure 5.6-01 (Existing and Planned Water Quality Monitoring Network) shows that no monitoring wells are located across portions of the basin near DACs and domestic wells (see maps provided in Attachment E). Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[11].

The GSP provides discussion of data gaps for GDEs and ISWs in Section 5.3.4 of the GSP (Assessment and Improvement of Monitoring Network) and provides planned monitoring well locations on Figure 5.3-01 (Existing and Planned Groundwater Level Monitoring Wells). The GSP could be improved by describing the aquatic GDE monitoring programs for the Foster Park and Confluence Aquatic Habitat Areas (p. 159) and how they will be used to assess the potential for significant and unreasonable impacts to GDEs and ISWs due to groundwater conditions in the basin.

RECOMMENDATIONS
● Provide maps that overlay monitoring well locations with the locations of DACs and domestic wells to clearly identify potentially impacted areas. Increase the number of representative monitoring sites (RMSs) in the shallow aquifer across the basin for the groundwater quality condition indicator. Prioritize proximity to DACs and drinking water users when identifying new RMSs. ● Choose single wells for water quality RMSs, instead of using well groups. If well groups are used, explain how the reporting requirements of SGMA will be met.

[11] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

- Further describe the biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the basin. The aquatic GDE monitoring programs for the Foster Park and Confluence Aquatic Habitat Areas are mentioned on p. 159 but no further details are provided.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to identify benefits or impacts of identified projects and management actions to beneficial users of groundwater such as DACs and tribes.

The GSP includes two projects and management actions with explicit benefits to the environment (Foster Park Protocols to Address Direct Depletion of Interconnected Surface Water and Actions to Address Indirect Depletion of Interconnected Surface Water). The only other project included in the GSP is a Domestic Well Survey to collect more information about domestic wells in the basin. The GSP does not discuss the manner in which DACs and tribes may be benefitted or impacted by projects and management actions identified in the GSP, nor does the GSP discuss the potential water quality impacts from groundwater management in the basin. Potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs, domestic well owners, and tribes, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[12].

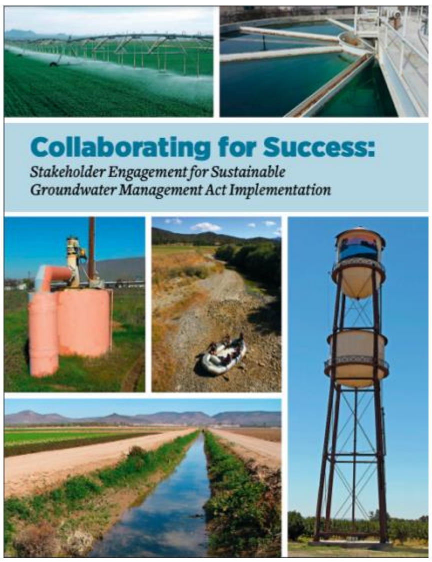
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[12] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



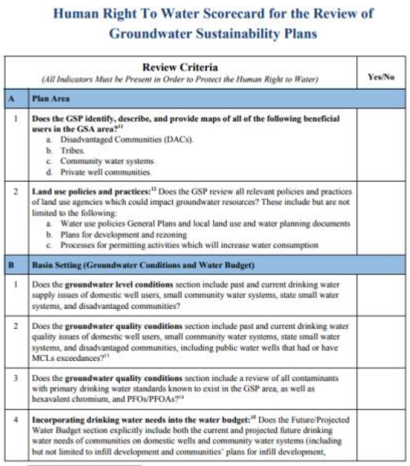
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

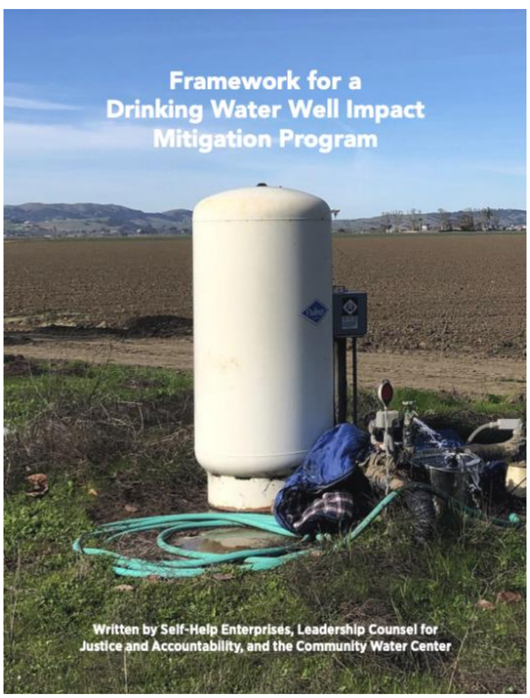


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

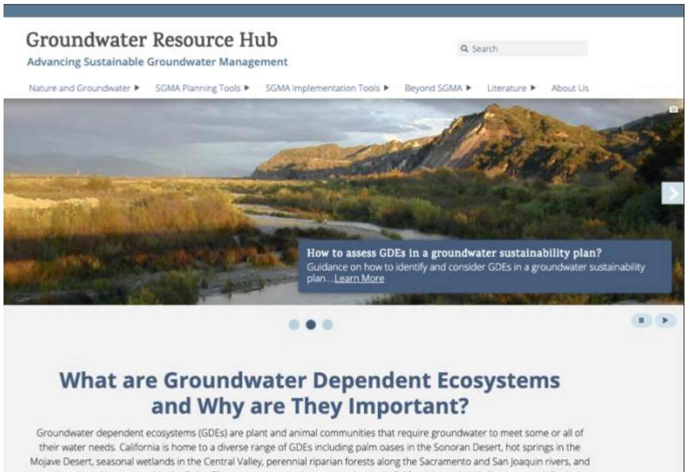
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



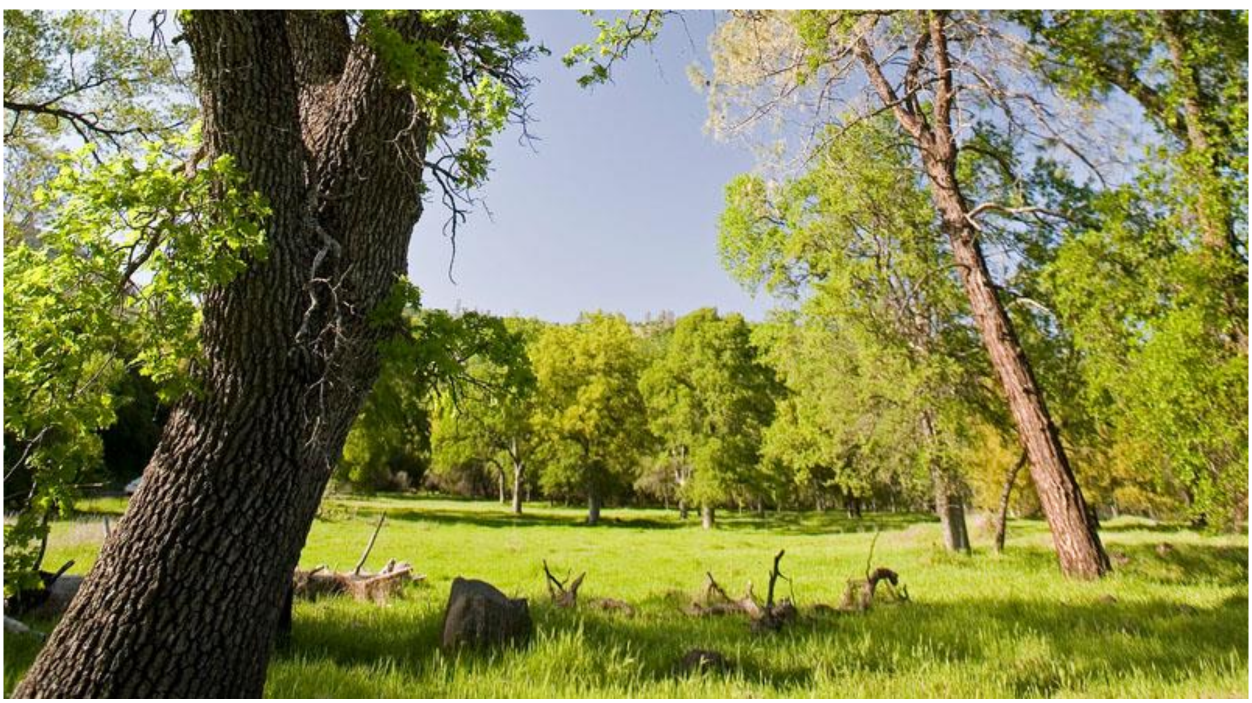
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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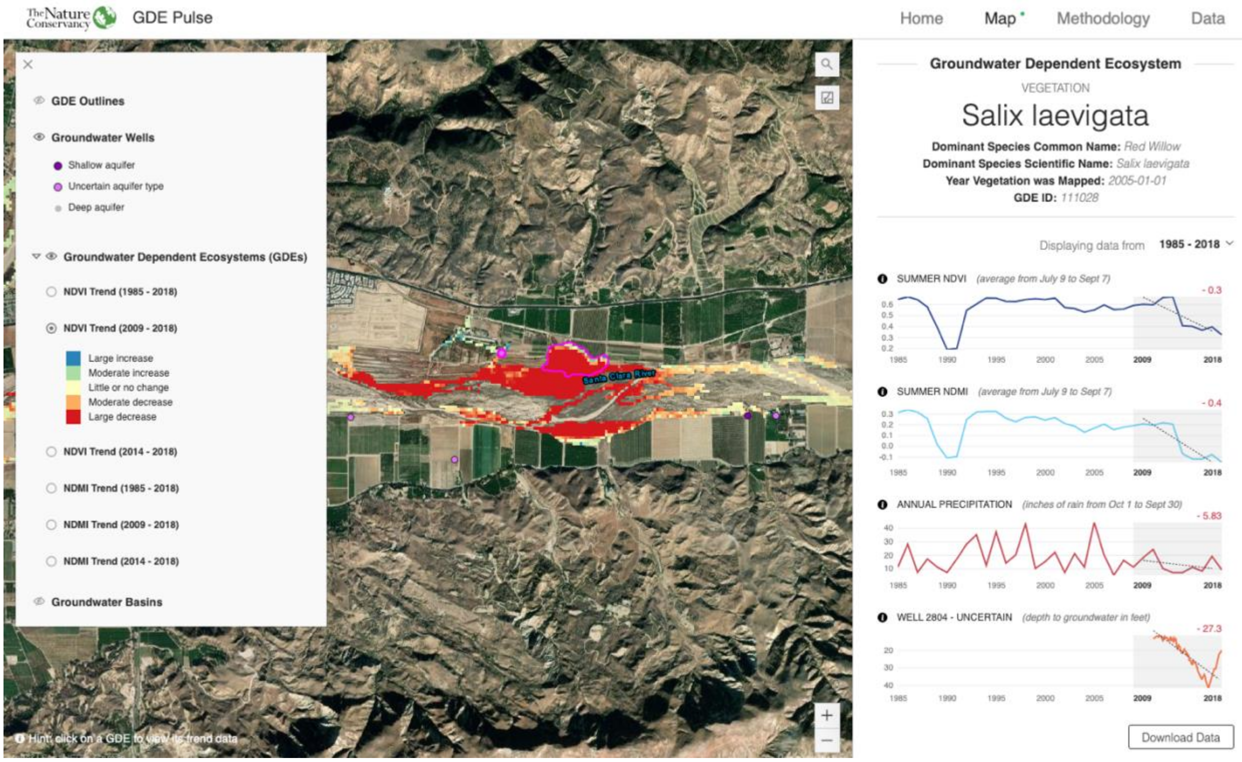
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

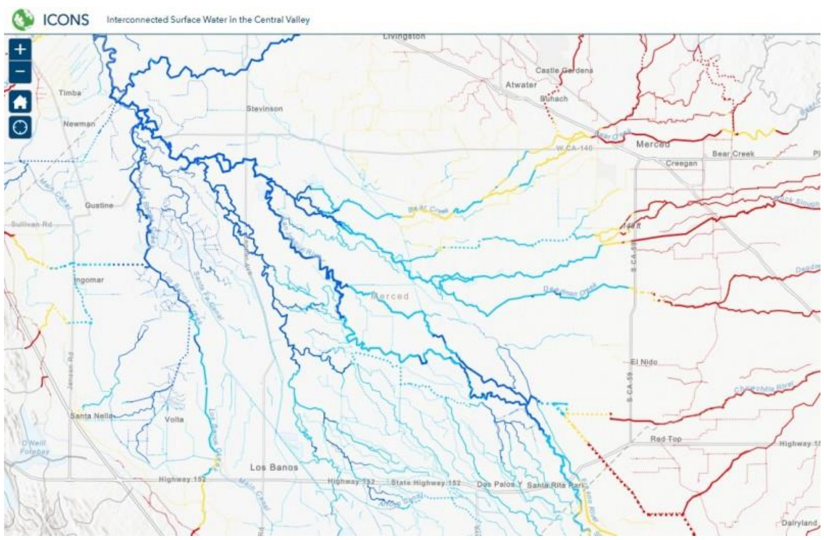
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Ventura River Valley - Upper Ventura River Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result “depletion of interconnected surface waters”, Attachment C provides a list of freshwater species located in the Ventura River Valley - Upper Ventura River Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife’s BIOS as well as on The Nature Conservancy’s science website.

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya collaris	Ring-necked Duck			
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Butorides virescens	Green Heron			
Calidris minutilla	Least Sandpiper			
Cistothorus palustris palustris	Marsh Wren			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority

Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Gammarus spp.	Gammarus spp.			
Hyalella spp.	Hyalella spp.			
FISHES				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus mykiss - Southern CA	Southern California steelhead	Endangered	Special Concern	Endangered - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Pseudacris cadaverina	California Treefrog			ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC

Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Pseudacris regilla	Northern Pacific Chorus Frog			
INSECTS AND OTHER INVERTS				
Ablabesmyia spp.	Ablabesmyia spp.			
Ambrysus spp.	Ambrysus spp.			
Apedilum spp.	Apedilum spp.			
Argia lugens	Sooty Dancer			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Baetidae fam.	Baetidae fam.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Caenis bajaensis	A Mayfly			
Caenis spp.	Caenis spp.			
Callibaetis spp.	Callibaetis spp.			
Centroptilum spp.	Centroptilum spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Cloeodes spp.	Cloeodes spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corisella decolor				Not on any status lists
Corixidae fam.	Corixidae fam.			
Cricotopus bicinctus				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cricotopus trifascia				Not on any status lists
Cryptochironomus spp.	Cryptochironomus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Dytiscidae fam.	Dytiscidae fam.			
Endochironomus spp.	Endochironomus spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Gomphidae fam.	Gomphidae fam.			

Hetaerina americana	American Rubyspot			
Hydrobius spp.	Hydrobius spp.			
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Labrundinia spp.	Labrundinia spp.			
Laccobius spp.	Laccobius spp.			
Larsia spp.	Larsia spp.			
Micrasema spp.	Micrasema spp.			
Microcylloepus spp.	Microcylloepus spp.			
Micropsectra spp.	Micropsectra spp.			
Microtendipes pedellus				Not on any status lists
Microtendipes spp.	Microtendipes spp.			
Microvelia spp.	Microvelia spp.			
Mideopsis spp.	Mideopsis spp.			
Nanocladius spp.	Nanocladius spp.			
Naucoridae fam.	Naucoridae fam.			
Nectopsyche spp.	Nectopsyche spp.			
Neoclypeodytes spp.	Neoclypeodytes spp.			
Nilothauma spp.	Nilothauma spp.			
Ochrotrichia spp.	Ochrotrichia spp.			
Ochthebius spp.	Ochthebius spp.			
Oecetis spp.	Oecetis spp.			
Ordobrevia nubifera				Not on any status lists
Oxyethira spp.	Oxyethira spp.			
Paltothemis lineatipes	Red Rock Skimmer			
Paracladopelma spp.	Paracladopelma spp.			
Paraleptophlebia spp.	Paraleptophlebia spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Pentaneura spp.	Pentaneura spp.			
Petrophila spp.	Petrophila spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polycentropus spp.	Polycentropus spp.			
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Psectrocladius spp.	Psectrocladius spp.			
Psectrotanypus spp.	Psectrotanypus spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhyacophila spp.	Rhyacophila spp.			

Sialis spp.	Sialis spp.			
Sigara mckinstryi	A Water Boatman			Not on any status lists
Sigara spp.	Sigara spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Tanytarsus spp.	Tanytarsus spp.			
Thienemannimyia spp.	Thienemannimyia spp.			
Tinodes spp.	Tinodes spp.			
Trichocorixa calva				Not on any status lists
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus spp.	Tropisternus spp.			
Veliidae fam.	Veliidae fam.			
Zavrelimyia spp.	Zavrelimyia spp.			
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Gyraulus spp.	Gyraulus spp.			
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
PLANTS				
Cotula coronopifolia	NA			
Eleocharis macrostachya	Creeping Spikerush			
Lythrum californicum	California Loosestrife			
Mimulus cardinalis	Scarlet Monkeyflower			
Persicaria lapathifolia				Not on any status lists
Rorippa palustris palustris	Bog Yellowcress			
Schoenoplectus californicus	California Bulrush			
Stuckenia pectinata				Not on any status lists
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	NA			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

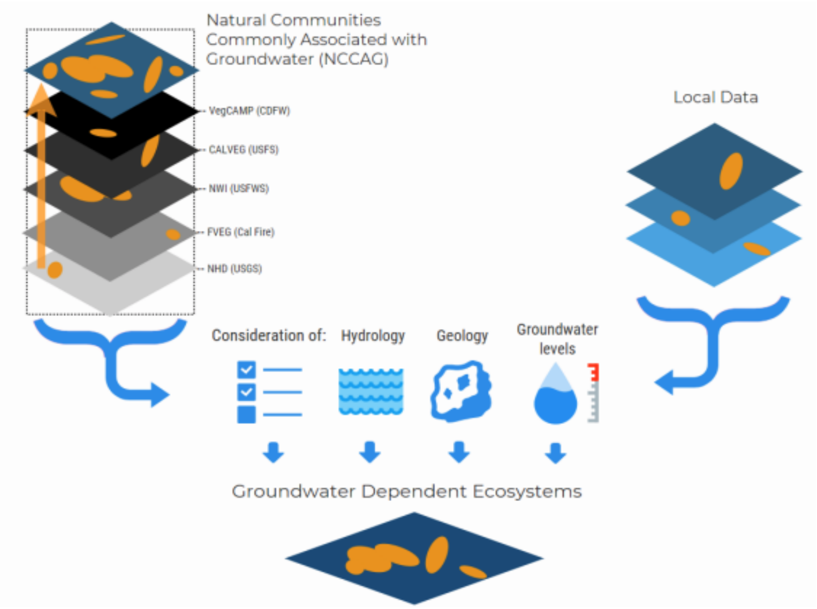


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

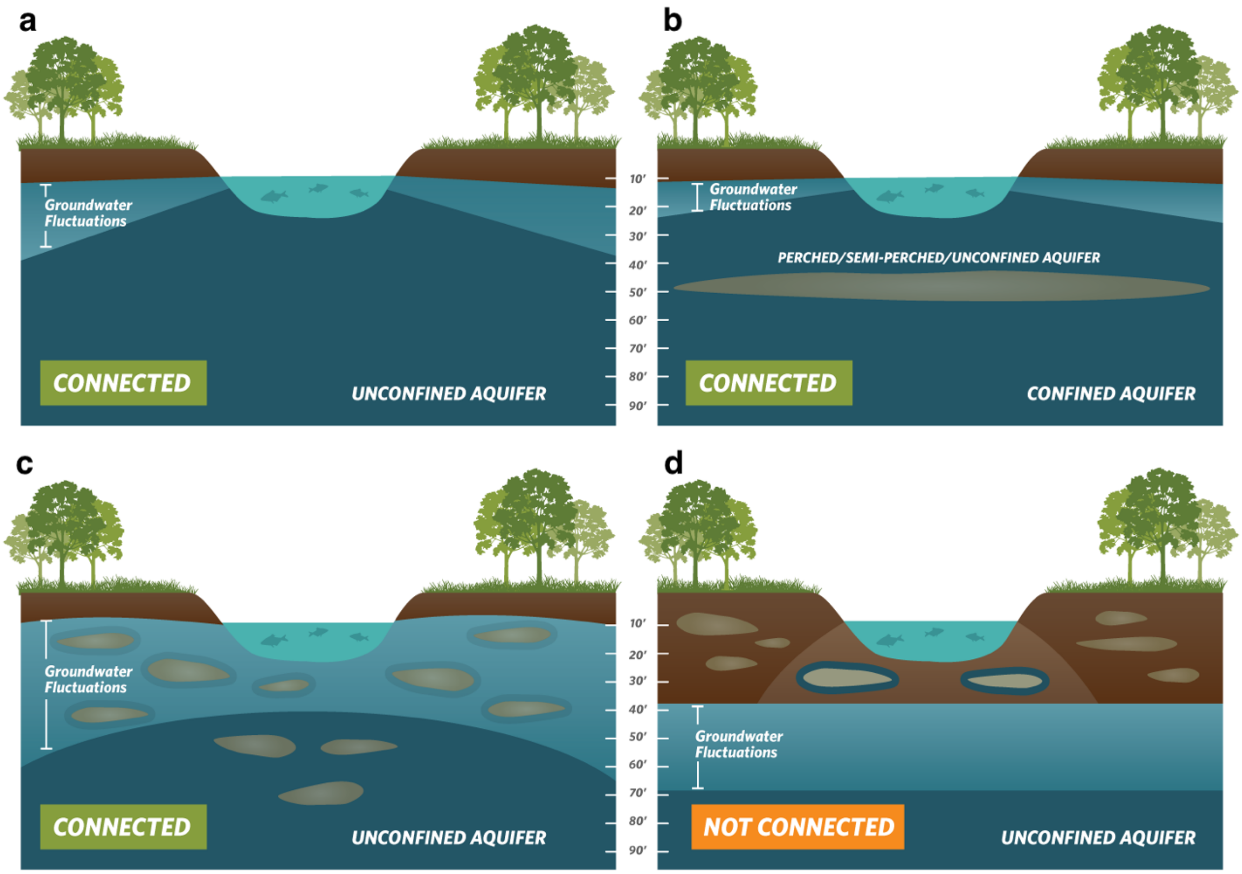

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

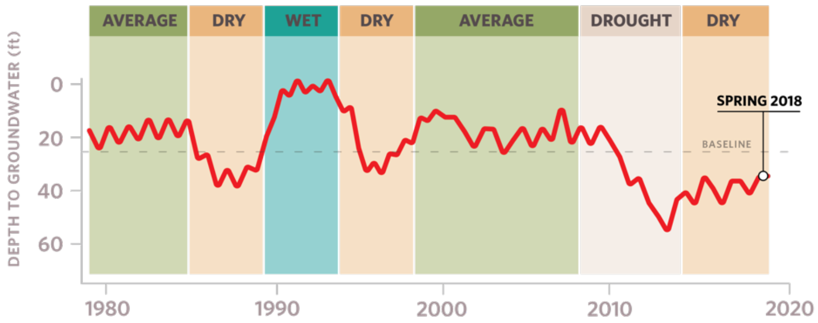

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

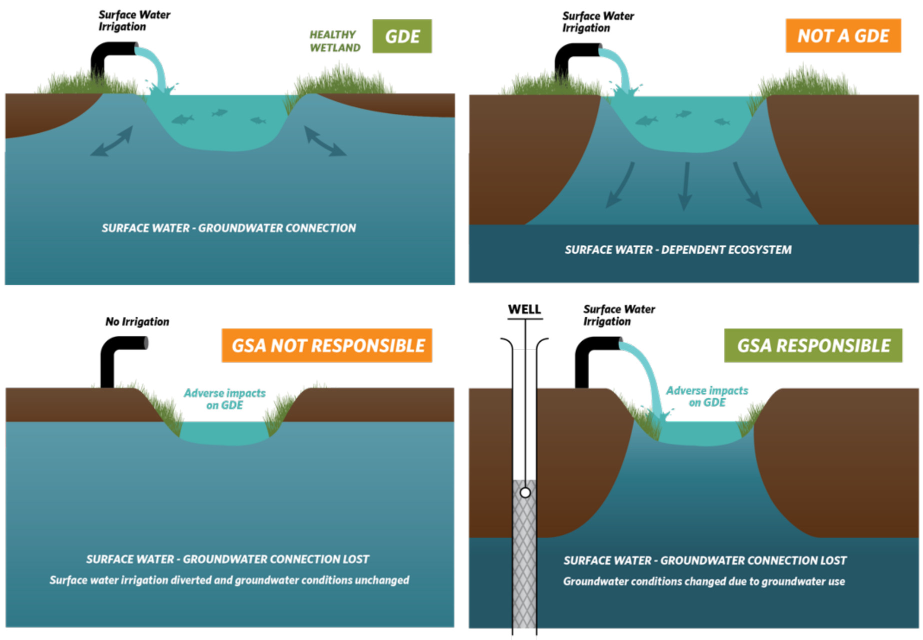

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

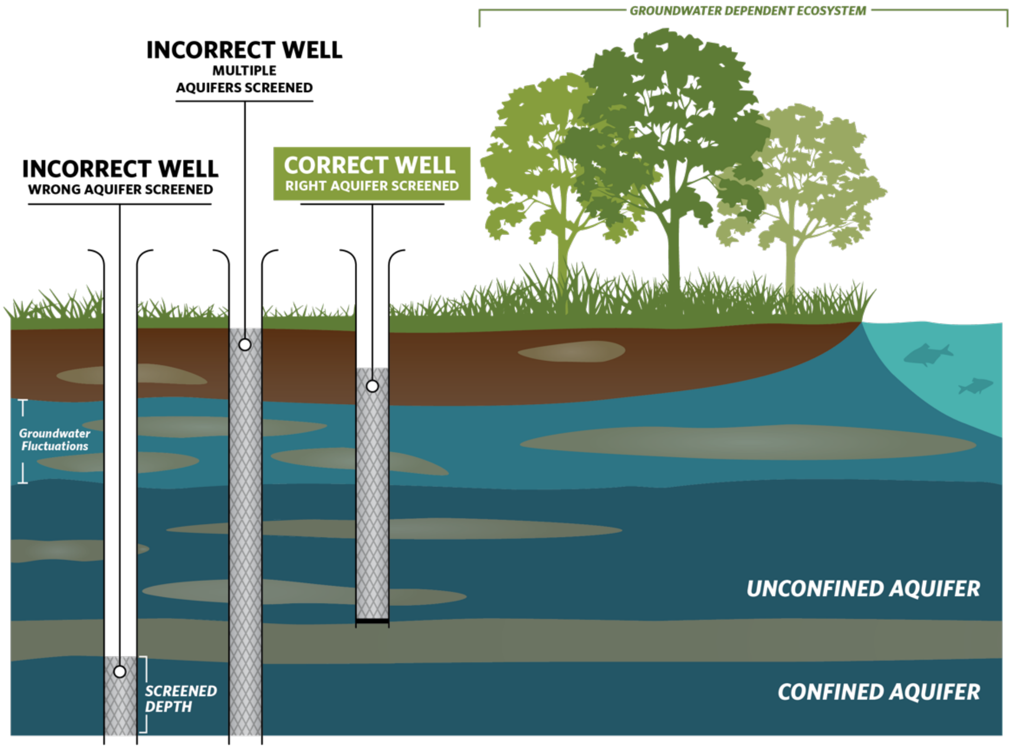

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

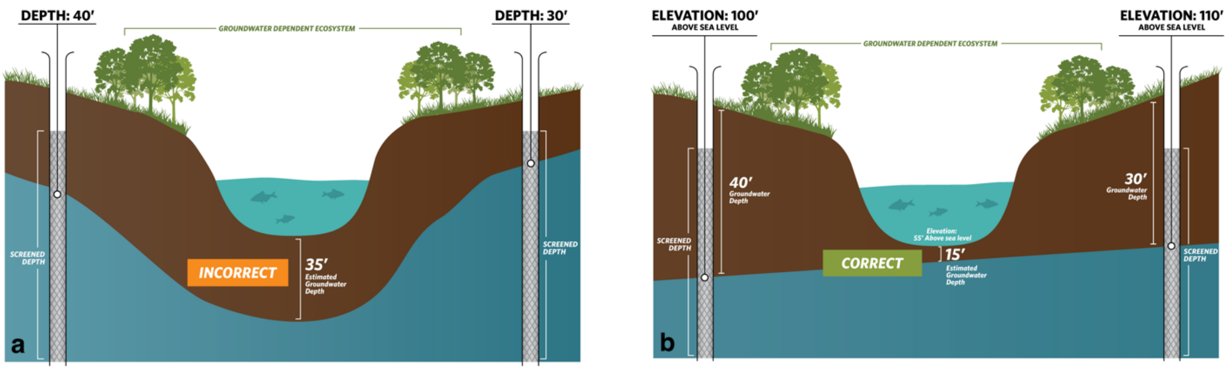

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

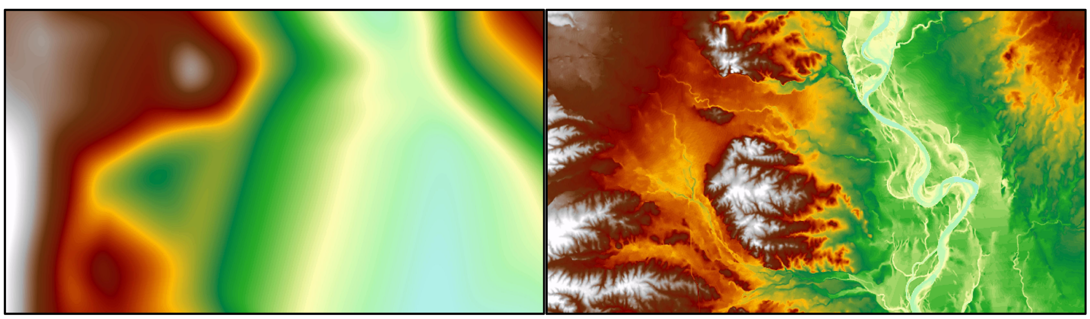

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

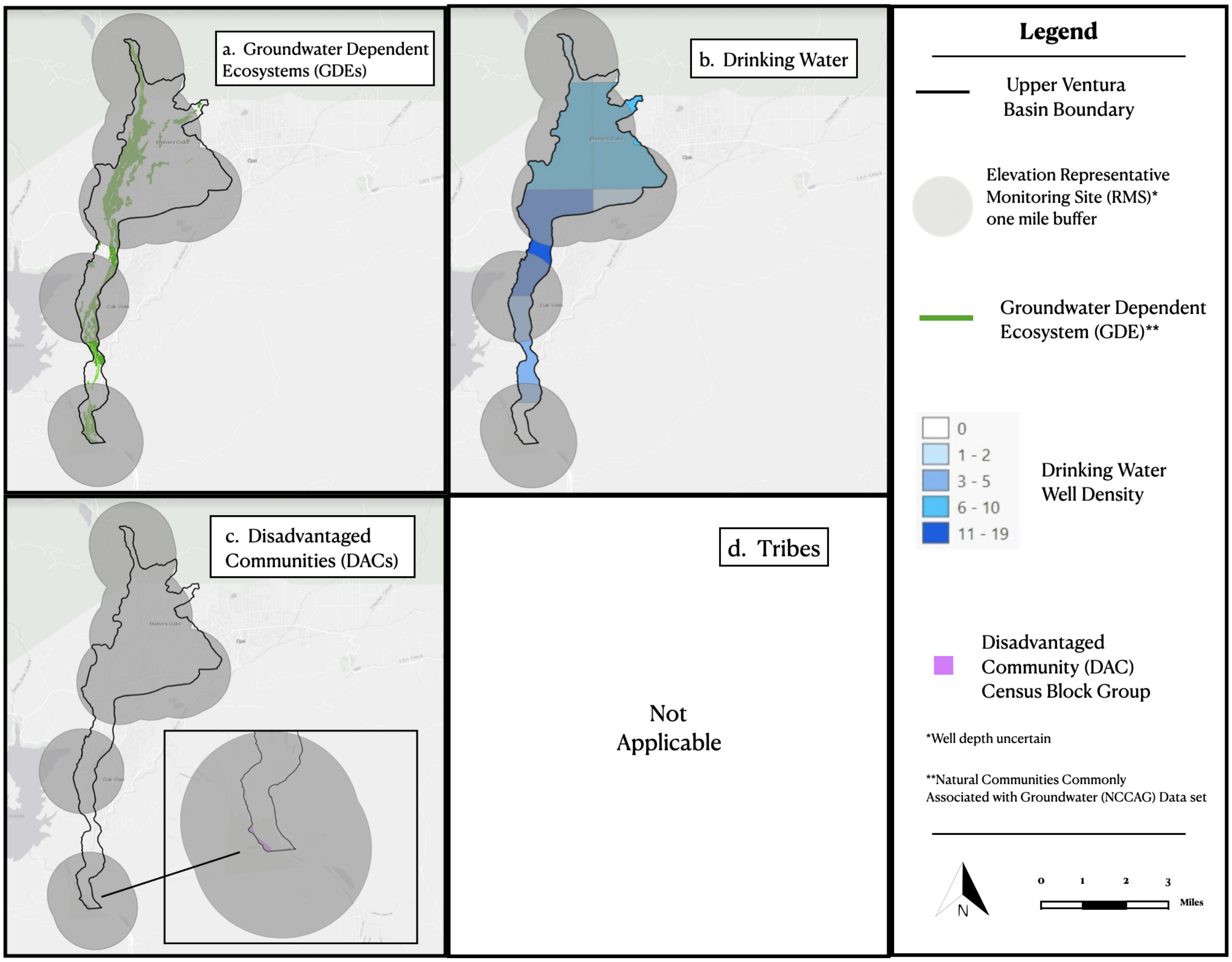

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

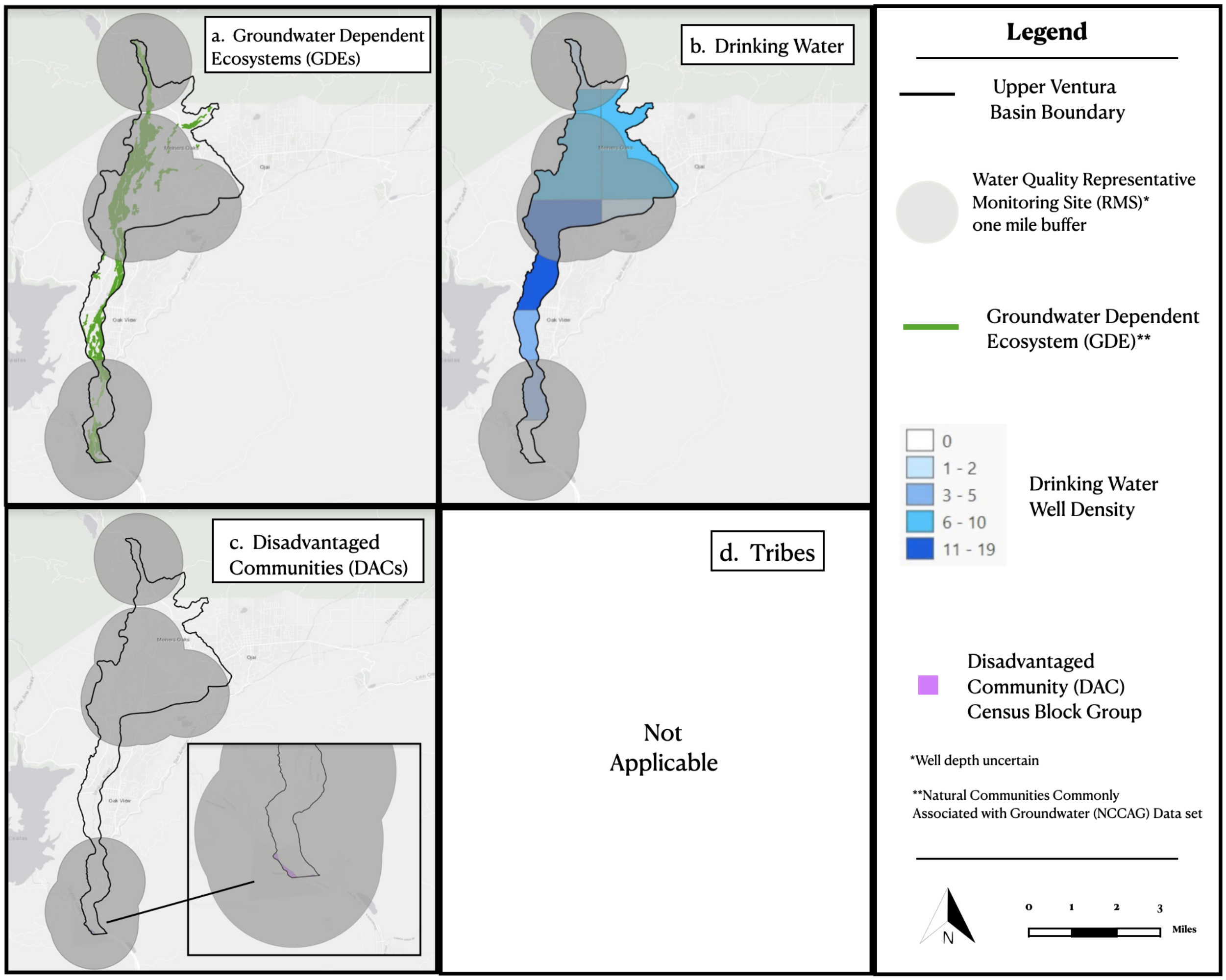

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

October 19, 2021

Vina GSA
308 Nelson Avenue
Oroville, CA 95965

Submitted via email: VinaGSA@gmail.com

Re: Public Comment Letter for Vina Subbasin Draft GSP

Dear Christina Buck,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Vina Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Vina Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
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Melissa M. Rohde
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The Nature Conservancy

Amy Merrill, Ph.D.
Acting Director, California Program
American Rivers

Kristan Culbert
Associate Director, California Central Valley River Conservation
American Rivers

Attachment A

Specific Comments on the Vina Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. The GSP provides information on DACs, including identification by name and location on a map. However, the plan fails to clearly document the population of each DAC. In addition, the GSP fails to include the population dependent on groundwater as their source of drinking water in the subbasin.

Appendix 1-D of the GSP states that the Mechoopda Indian Tribe of Chico Rancheria is located in Vina Subbasin. The location and map of tribal lands, however, is not provided.

While the plan provides a density map of domestic wells in the subbasin (Figure 1-9), the GSP fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.

These missing elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide the population of each identified DAC. Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). • Provide a map of tribal lands and describe the tribal population within the subbasin. • Include a map showing domestic well locations and average well depth across the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. GSP Section 2.2.6.2 (Evaluation of Surface Water Connectivity) describes well locations, proximity to streams, and screening depths that were used to evaluate surface water connectivity. However, Section 2.2.6.3 (Estimates of Surface

Water Connection Based on BBGM [Butte Basin Groundwater Model]) does not describe the data used in the BBGM model, such as the groundwater level monitoring well data and stream gauge data that were incorporated into the model. Additionally, no description was provided of the temporal (seasonal and interannual) variability of the data used to calibrate the model. This information should be provided in the GSP to support the conclusions presented.

Figure 2-26 presents a map of stream reaches in the subbasin, showing the percentage of months of either a gaining or losing condition in the subbasin as predicted by the BBGM model. Based on the color coding it appears that all surface water is considered to be connected, but the percentage of connection for many of the upland streams and tributaries in the subbasin are labeled 0%. Therefore it is not clear what is an ISW and what is not based on this map. We recommend that these labels are clarified in the text so it is more clear which stream segments are retained as ISWs or potential ISWs in the GSP and to include a description of the logic behind determining which reaches are and are not ISWs. Note the regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

RECOMMENDATIONS

- Describe the legend labels used on Figure 2-26 in the GSP text to make clear which stream segments are retained as ISWs or potential ISWs in the GSP.

- Further describe the groundwater elevation data and stream flow data used in the BBGM analysis. Ensure depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) are used to determine the range of depth and capture the variability in environmental conditions inherent in California's climate.

- To confirm and illustrate the results of the groundwater modeling, overlay the stream reaches shown on Figure 2-26 with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis.

- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

- Describe data gaps for the ISW analysis in the ISW section, in addition to the discussion in the HCM section (2.1.9.2). On Figure 2-26, include reaches with data gaps as potential ISWs.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP does not discuss how the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) was verified with the use of groundwater data from the shallow aquifer. Without an analysis of groundwater data to verify the NC dataset polygons, it will be difficult or impossible to adequately monitor and manage the subbasin's GDEs throughout GSP implementation.

The GSP took initial steps to identify and map GDEs using the NC dataset and other sources. However, we found that some mapped features in the NC dataset were improperly disregarded. NC dataset polygons were incorrectly removed in areas adjacent to irrigated fields or due to the presence of surface water supplies. However, this removal criteria is flawed since GDEs, in addition to groundwater, can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields – simultaneously and at different temporal/spatial scales. NC dataset polygons adjacent to irrigated land or surface water supplies can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to irrigated fields or surface water.

The GSP did not discuss the flora or fauna species present in the subbasin's GDEs, except to acknowledge the presence of Valley oak (*Quercus lobata*) in the subbasin. We commend the GSAs for retaining all Valley oak polygons in the NC dataset based on the recognition that they can access groundwater at deeper depths.

RECOMMENDATIONS

- Provide a comprehensive set of maps for the subbasin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained, removed, or added to/from the NC dataset (include the removal reason if polygons are not considered potential GDEs, or include the data source if polygons are added). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network. It is not clear from the description in the GSP whether NC dataset polygons labeled as 'Not Likely a GDE' are retained as potential GDEs.

- Include an inventory of the fauna and flora present within the subbasin's GDEs (see Attachment C of this letter for a list of freshwater species located in the Vina Subbasin). Note any threatened or endangered species.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included in the water budget. The integration of these ecosystems into the water budget is **sufficient** because the groundwater demands of native vegetation and managed wetlands are included in the historical, current, and projected water budgets. Additional clarification is needed on why the current and projected water demands for managed wetlands are approximately half the water demands represented in the historical water budget (Table 2-7). These ecosystems will have continued or higher water needs in the future to provide habitat for migratory birds.

RECOMMENDATION

- Revisit the current and projected water demands for managed wetlands, which are represented in the GSP as approximately half the historical water demands. Provide a justification for these water budget values for managed wetlands in Table 2-7. Also, provide the water budget model documentation referenced in the GSP (BCDWRC 2021).

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the Communication and Engagement Plan (Appendix 1-D).

The Communication and Engagement Plan documents representation of tribal and environmental interests during the GSP development process. A tribal staff member from the Mechoopda Indian Tribe of Chico Rancheria has represented the tribe during GSP development and participates as a member of the Vina GSA Management Committee. Additionally, there is an environmental representative on the GSA Advisory Committee.

However, we note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement with DACs and drinking water users are described in very general terms. They include meetings open to the public, including GSA Board meetings, meetings in conjunction with the Reclamation District,

[1] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[2] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[3] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

subbasin-wide technical meetings, Farm Bureau Water Forum meeting, City of Chico meetings, and Regional Water Management Group meetings. No specific outreach targeted to DACs is described in the GSP.

- The GSP describes an Engagement Matrix in Appendix 1-F for engaging with DACs, tribes, and environmental stakeholders through the implementation phase. However, Appendix 1-F was not included in the Draft GSP.

RECOMMENDATION
● In the Communication and Engagement Plan, describe active and targeted outreach to engage DAC members, drinking water users, environmental stakeholders and consultation to tribes through the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results[4] and establishing minimum thresholds.[5,6]

Disadvantaged Communities and Drinking Water Users
For chronic lowering of groundwater levels, the GSP discusses minimum thresholds impact on domestic wells (see Section 3.3.2 Minimum Thresholds). The GSP states (p. 103): *"In recent years, Butte County has documented a number of domestic wells that have "gone dry," meaning groundwater levels have fallen below the depth of the well installation and/or pump. This occurred during summer months of recent drought years and heightened concern among some stakeholders. As a result, domestic well reliability and protection are the focus of the Groundwater Levels MT."* The GSP discusses the use of the DWR domestic well database and sets minimum threshold levels protective of domestic wells by establishing a representative zone for each RMS well.

The GSP does not however, sufficiently describe or analyze direct or indirect impacts on DACs or tribes when defining undesirable results, nor does it describe how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results to DACs and tribes in the subbasin.

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[4] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
[5] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[6] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

For degraded water quality, salinity is the only constituent of concern (COC) for which SMC are established in the Vina Subbasin. The minimum threshold is set to the upper limit of the Secondary Maximum Contaminant Level (SMCL) for specific conductance based on the state secondary drinking water standards. The GSP states (p. 108): *"Other constituents, as discussed in Section 2.2.4, are managed through existing management and regulatory programs within the Subbasin, such as the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) and the Irrigated Lands Regulatory Program (ILRP), which focus on improving water quality by managing septic and agricultural sources of salinity and nutrients. Additionally, point-source contaminants are managed and regulated through a variety of programs by the Regional Water Quality Control Board (RWQCB), Department of Toxic Substances Control (DTSC), and the U.S. Environmental Protection Agency (EPA)."* However, SMC should be established for all COCs including chemicals of emerging concern (CEC) in the subbasin impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

The GSP only includes a very general discussion of impacts to drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs, drinking water users or tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on beneficial users.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels (in addition to describing impacts to drinking water users).

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[7]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management. Ensure they align with drinking water standards[8].

[7] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[8] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts to GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC for chronic lowering of groundwater levels.

The GSP recognizes a data gap with respect to the interconnected surface water SMC. The GSP states (p. 113): *"The GSAs in the Vina Subbasin intend to further evaluate this SMC to avoid undesirable results to aquatic ecosystems and GDEs. To that end, an Interconnected Surface Water SMC framework has been developed for the GSP as described below. This framework will guide future data collection efforts to fill data gaps, either as part of GSP projects and management actions or plan implementation."*

While the data gap is being filled, the SMC for depletion of interconnected surface water are established by proxy using groundwater levels. The GSP states (p. 115): *"Therefore, at this time, Groundwater Levels SMC are used by proxy and the MT for interconnected surface water is the same as for groundwater levels: Two RMS wells reach their MT for two consecutive non-dry year-types."* However, no analysis or discussion is presented to describe how the SMC will affect GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- Define chronic lowering of groundwater SMC directly for environmental beneficial users of groundwater. When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[9] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[10] can be determined.

- When establishing SMC for the basin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs should include "impacts on groundwater dependent ecosystems".

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[9] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[10] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached[11]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,12].

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[13] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

The GSP includes climate change into key inputs (e.g., precipitation, evapotranspiration, and surface water flow) of the projected water budget. However, the sustainable yield is based on historic pumping rates instead of the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, tribes, and domestic well owners.

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[11] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[12] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[13] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

RECOMMENDATIONS
• Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions. • Calculate sustainable yield based on the projected water budget with climate change incorporated. • Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, tribes, GDEs, and ISWs in the subbasin.

Figure 4-5 (Groundwater Level RMS Wells) and Figure 4-6 (Water Quality RMS Wells) show that no monitoring wells are located across portions of the subbasin near DACs, domestic wells, and tribes (see maps provided in Attachment E). Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[14].

The GSP provides some discussion of data gaps for GDEs and ISWs in Sections 4.10 (Network Assessment and Improvements) and Section 6.1.3 (Data Analysis), however does not provide specific plans, such as locations or a timeline, to fill the data gaps.

RECOMMENDATIONS
• Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, tribes, GDEs, and ISWs to clearly identify potentially impacted areas. Increase the number of RMSs in the shallow aquifer across the subbasin as needed to adequately monitor all groundwater condition indicators. Prioritize proximity to DACs, domestic wells, tribes, and GDEs when identifying new RMSs. • Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

[14] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, drinking water users, and tribes. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

The GSP includes projects and management actions with explicit benefits to the environment. The plan also includes a domestic well mitigation program. However, the mitigation program is described as a potential project instead of a proposed project that will be implemented within the GSP planning horizon.

RECOMMENDATIONS

- Clarify the planning horizon of the described domestic well mitigation program to ensure that it will proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSAs plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[15].

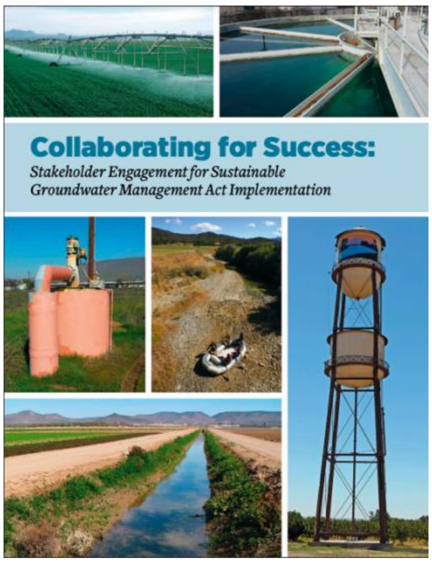
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[15] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

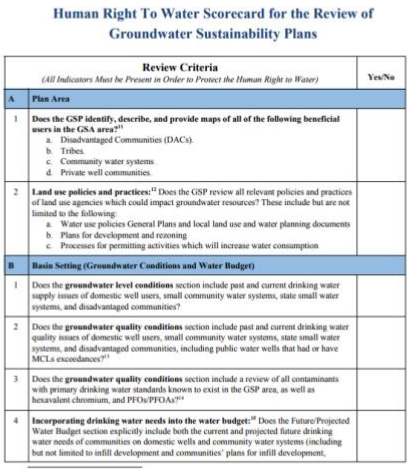
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

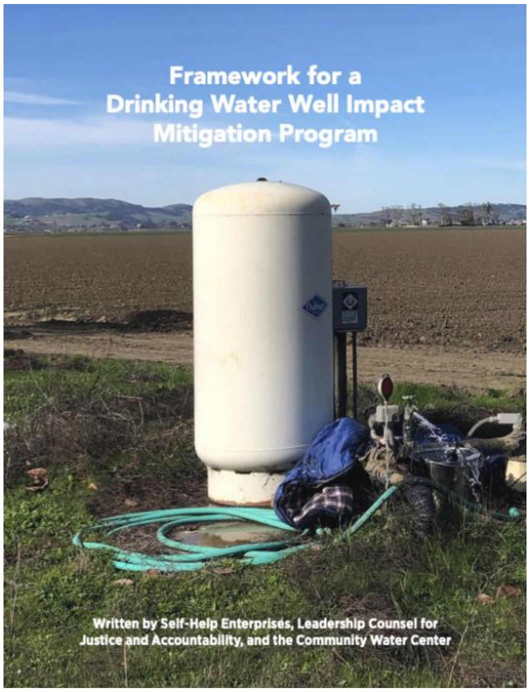


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

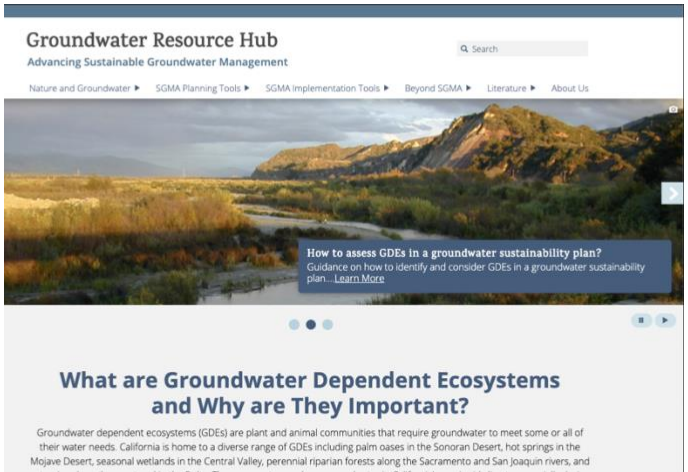
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



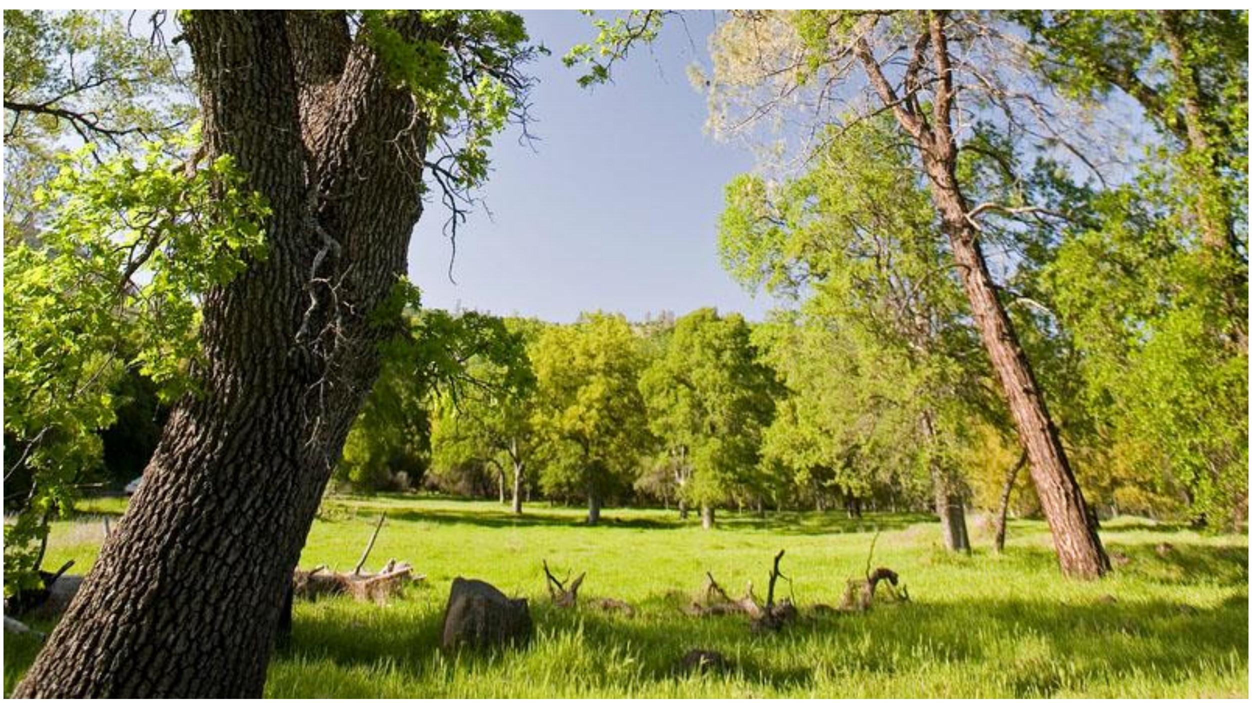
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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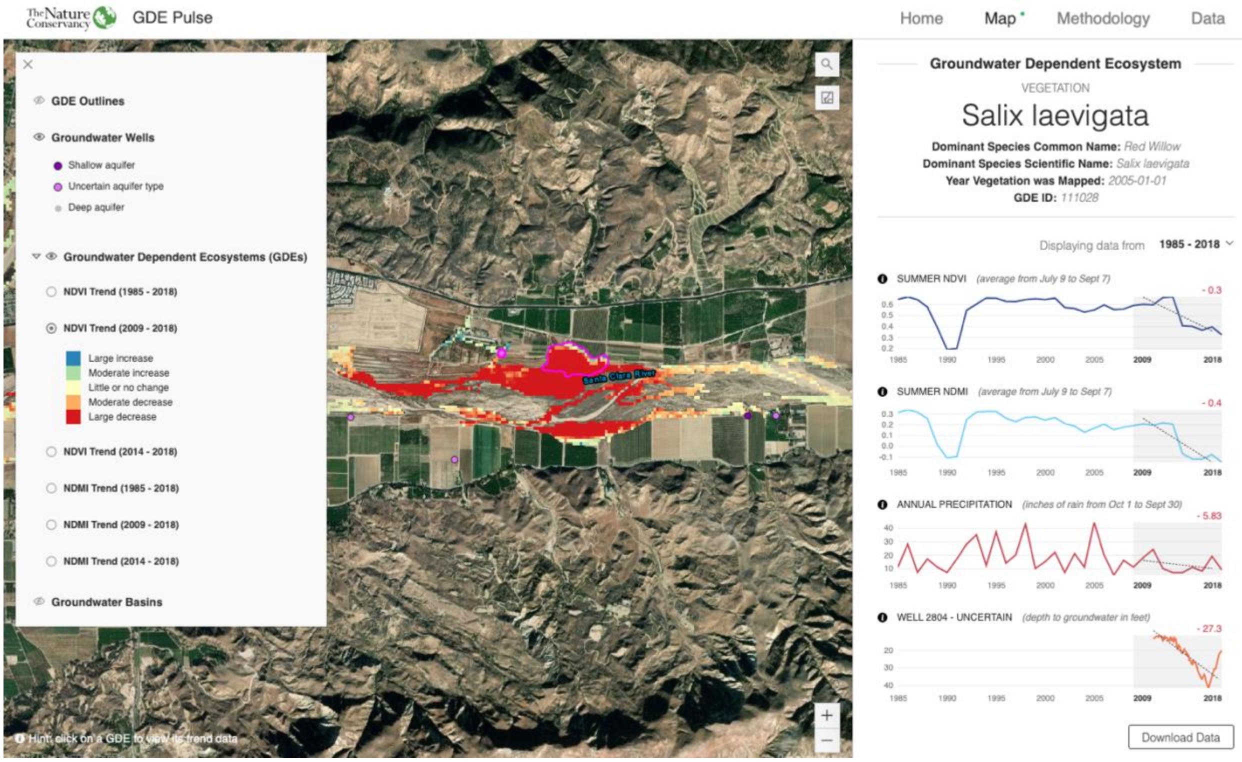
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

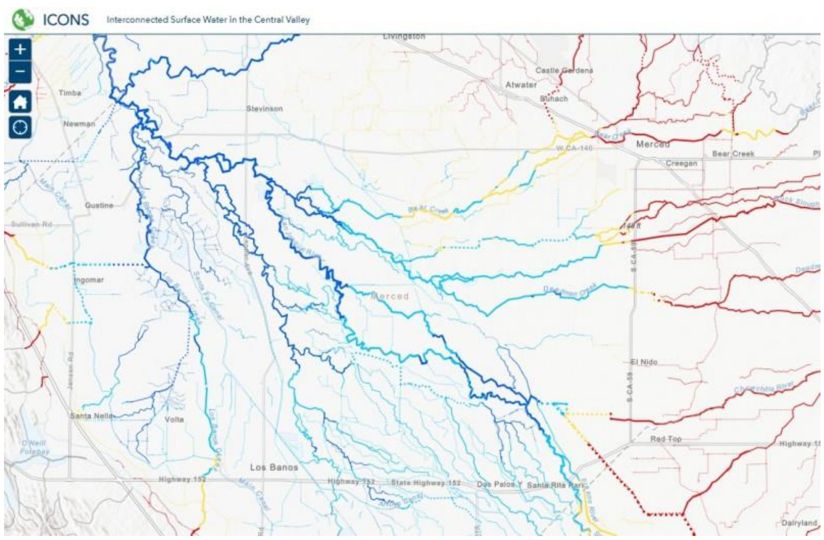
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Vina Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Vina Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Candidate - Threatened	Endangered	
Riparia riparia	Bank Swallow		Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Laterallus jamaicensis coturniculus	California Black Rail	Bird of Conservation Concern	Threatened	
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Recurvirostra americana	American Avocet			

Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta conservatio	Conservancy Fairy Shrimp	Endangered	Special	IUCN - Endangered
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
Branchinecta mackini	Alkali Fairy Shrimp			
Branchinecta mesovallensis	Midvalley Fairy Shrimp		Special	
Cambaridae fam.	Cambaridae fam.			
Hyalella spp.	Hyalella spp.			
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endangered	Endangered	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			

Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Ablabesmyia spp.	Ablabesmyia spp.			
Acentrella turbida	A Mayfly			
Ambrysus spp.	Ambrysus spp.			
Anax junius	Common Green Darner			
Antocha spp.	Antocha spp.			
Apedilum spp.	Apedilum spp.			
Argia agrioides	California Dancer			
Argia emma	Emma's Dancer			
Argia lugens	Sooty Dancer			
Argia nahuana	Aztec Dancer			
Argia spp.	Argia spp.			
Argia vivida	Vivid Dancer			
Asioplax spp.	Asioplax spp.			
Baetidae fam.	Baetidae fam.			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Berosus spp.	Berosus spp.			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Brillia spp.	Brillia spp.			
Caenis latipennis	A Mayfly			
Caenis spp.	Caenis spp.			
Callibaetis spp.	Callibaetis spp.			
Camelobaetidius warreni	A Mayfly			
Cardiocladius spp.	Cardiocladius spp.			
Centroptilum spp.	Centroptilum spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chimarra spp.	Chimarra spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corixidae fam.	Corixidae fam.			
Cricotopus nostocicola				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Despaxia augusta	Smooth Needleflyl			
Dicrotendipes spp.	Dicrotendipes spp.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Dolophilodes spp.	Dolophilodes spp.			
Dytiscidae fam.	Dytiscidae fam.			

Ecdyonurus criddlei	A Mayfly			
Elmidae fam.	Elmidae fam.			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Enallagma cyathigerum				Not on any status lists
Epeorus spp.	Epeorus spp.			
Ephemerellidae fam.	Ephemerellidae fam.			
Erythemis collocata	Western Pondhawk			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Glossosoma spp.	Glossosoma spp.			
Gomphus kurilis	Pacific Clubtail			
Gumaga spp.	Gumaga spp.			
Helicopsyche spp.	Helicopsyche spp.			
Helochares normatus				Not on any status lists
Heptageniidae fam.	Heptageniidae fam.			
Hetaerina americana	American Rubyspot			
Hydrobius fuscipes				Not on any status lists
Hydropsyche californica	A Caddisfly			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Ischnura perparva	Western Forktail			
Labrundinia spp.	Labrundinia spp.			
Laccobius spp.	Laccobius spp.			
Larsia spp.	Larsia spp.			
Lepidostoma spp.	Lepidostoma spp.			
Leptoceridae fam.	Leptoceridae fam.			
Leptohyphidae fam.	Leptohyphidae fam.			
Leucotrichia pictipes	A Micro Caddisfly			
Libellula forensis	Eight-spotted Skimmer			
Libellula luctuosa	Widow Skimmer			
Libellula pulchella	Twelve-spotted Skimmer			
Libellula saturata	Flame Skimmer			
Libellulidae fam.	Libellulidae fam.			
Liodessus obscurellus				Not on any status lists
Macromia magnifica	Western River Cruiser			
Microcylloepus similis				Not on any status lists
Microcylloepus spp.	Microcylloepus spp.			
Micropsectra spp.	Micropsectra spp.			
Microtendipes spp.	Microtendipes spp.			

Mideopsis spp.	Mideopsis spp.			
Mystacides alafimbriatus	A Caddisfly			
Mystacides spp.	Mystacides spp.			
Nanocladius spp.	Nanocladius spp.			
Nectopsyche spp.	Nectopsyche spp.			
Nilothauma spp.	Nilothauma spp.			
Ochrotrichia spp.	Ochrotrichia spp.			
Oecetis disjuncta	A Caddisfly			
Oecetis spp.	Oecetis spp.			
Ophiogomphus bison	Bison Snaketail			
Optioservus spp.	Optioservus spp.			
Oxyethira spp.	Oxyethira spp.			
Pachydiplax longipennis	Blue Dasher			
Paltothemis lineatipes	Red Rock Skimmer			
Pantala hymenaea	Spot-winged Glider			
Parakiefferiella spp.	Parakiefferiella spp.			
Paraleptophlebia spp.	Paraleptophlebia spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Peltodytes spp.	Peltodytes spp.			
Pentaneura spp.	Pentaneura spp.			
Petrophila spp.	Petrophila spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Plathemis lydia	Common Whitetail			
Polycentropus spp.	Polycentropus spp.			
Polypedilum spp.	Polypedilum spp.			
Procloeon spp.	Procloeon spp.			
Progomphus borealis	Gray Sanddragon			
Protoptila spp.	Protoptila spp.			
Psectrocladius spp.	Psectrocladius spp.			
Psephenus falli				Not on any status lists
Pseudochironomus spp.	Pseudochironomus spp.			
Pseudosmittia spp.	Pseudosmittia spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhyacophila spp.	Rhyacophila spp.			
Sanfilippodytes spp.	Sanfilippodytes spp.			
Serratella micheneri	A Mayfly			
Sialis spp.	Sialis spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Stenochironomus spp.	Stenochironomus spp.			
Stenocolus scutellaris				Not on any status lists
Stictotarsus spp.	Stictotarsus spp.			
Sympetrum corruptum	Variegated Meadowhawk			
Tanypus spp.	Tanypus spp.			
Tanytarsus spp.	Tanytarsus spp.			

Telebasis salva	Desert Firetail			
Tinodes spp.	Tinodes spp.			
Tramea lacerata	Black Saddlebags			
Tricorythodes spp.	Tricorythodes spp.			
Tvetenia spp.	Tvetenia spp.			
Zaitzevia spp.	Zaitzevia spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Ferrissia spp.	Ferrissia spp.			
Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus spp.	Gyraulus spp.			
Helisoma spp.	Helisoma spp.			
Lymnaea spp.	Lymnaea spp.			
Margaritifera falcata	Western Pearlshell		Special	
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Sphaeriidae fam.	Sphaeriidae fam.			
PLANTS				
Limnanthes floccosa californica	Shippee Meadowfoam	Endangered	Endangered	CRPR - 1B.1
Limnanthes floccosa floccosa	Woolly Meadowfoam		Special	CRPR - 4.2
Orcuttia pilosa	Hairy Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Orcuttia tenuis	Slender Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Rhynchospora californica	California Beakrush		Special	CRPR - 1B.1
Sagittaria sanfordii	Sanford's Arrowhead		Special	CRPR - 1B.2
Tuctoria greenei	Green's Awnless Orcutt Grass	Endangered	Rare	CRPR - 1B.1
Alisma triviale	Northern Water-plantain			
Alnus rhombifolia	White Alder			
Alnus rubra	Red Alder			
Alopecurus aequalis aequalis	Short-awn Foxtail			
Alopecurus carolinianus	Tufted Foxtail			
Alopecurus geniculatus geniculatus	Meadow Foxtail			
Alopecurus saccatus	Pacific Foxtail			

Ammannia coccinea	Scarlet Ammannia			
Ammannia robusta	Grand Redstem			
Arundo donax	NA			
Azolla filiculoides	NA			
Baccharis salicina				Not on any status lists
Bacopa rotundifolia	NA			
Bergia texana	Texas Bergia			
Boehmeria cylindrica	NA			Not on any status lists
Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Carex densa	Dense Sedge			
Carex feta	Green-sheath Sedge			
Carex nudata	Torrent Sedge			
Carex vulpinoidea	NA			
Cephalanthus occidentalis	Common Buttonbush			
Ceratophyllum demersum	Common Hornwort			
Chamaecyparis lawsoniana				Not on any status lists
Cicendia quadrangularis	Oregon Microcala			
Crassula aquatica	Water Pygmyweed			
Crypsis vaginiflora	NA			
Cyperus bipartitus	Shining Flatsedge			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus flavescens	NA			
Cyperus fuscus	NA			
Cyperus squarrosus	Awned Cyperus			
Damasonium californicum				Not on any status lists
Darmera peltata	Umbrella Plant			
Datisca glomerata	Durango Root			
Downingia bella	Hoover's Downingia			
Downingia bicornuta	NA			
Downingia cuspidata	Toothed Calicoflower			
Downingia ornatissima	NA			
Downingia pusilla	Dwarf Downingia		Special	CRPR - 2B.2
Echinochloa oryzoides	NA			
Echinodorus berteroi	Upright Burhead			
Elatine brachysperma	Shortseed Waterwort			
Elatine californica	California Waterwort			
Elatine heterandra	Mosquito Waterwort			
Elatine rubella	Southwestern Waterwort			

Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis acicularis gracilescens	Least Spikerush			
Eleocharis acicularis occidentalis				Not on any status lists
Eleocharis atropurpurea	Purple Spikerush			
Eleocharis bella	Delicate Spikerush			
Eleocharis coloradoensis				Not on any status lists
Eleocharis engelmannii engelmannii	Engelmann's Spikerush			Not on any status lists
Eleocharis flavescens flavescens	Pale Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis parishii	Parish's Spikerush			
Eleocharis quadrangulata	NA			
Eleocharis radicans	Rooted Spikerush			
Eleocharis rostellata	Beaked Spikerush			
Elodea canadensis	Broad Waterweed			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Epipactis gigantea	Giant Helleborine			
Eryngium aristulatum aristulatum	California Eryngo			
Eryngium articulatum	Jointed Coyote-thistle			
Eryngium castrense	Great Valley Eryngo			
Eryngium vaseyi vallicola				Not on any status lists
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euphorbia hooveri	NA			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Fimbristylis autumnalis	NA			
Gratiola ebracteata	Bractless Hedge-hyssop			
Gratiola heterosepala	Boggs Lake Hedge-hyssop		Endangered	CRPR - 1B.2
Hypericum anagalloides	Tinker's-penny			
Isoetes howellii	NA			
Isoetes nuttallii	NA			
Isoetes orcuttii	NA			
Juncus acuminatus	Sharp-fruit Rush			
Juncus dubius	Mariposa Rush			
Juncus effusus pacificus				
Juncus uncialis	Inch-high Rush			

Juncus usitatus	NA			Not on any status lists
Lasthenia fremontii	Fremont's Goldfields			
Lasthenia glabrata coulteri	Coulter's Goldfields		Special	CRPR - 1B.1
Leersia oryzoides	Rice Cutgrass			
Lemna minor	Lesser Duckweed			
Lemna minuta	Least Duckweed			
Limnanthes alba alba	White Meadowfoam			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limnanthes douglasii rosea	Douglas' Meadowfoam			
Limosella acaulis	Southern Mudwort			
Lindernia dubia	Yellowseed False Pimpernel			
Lipocarpha micrantha	Dwarf Bulrush			
Ludwigia palustris	Marsh Seedbox			
Ludwigia peploides montevidensis	NA			Not on any status lists
Ludwigia peploides peploides	NA			Not on any status lists
Lycopus americanus	American Bugleweed			
Lythrum portula	NA			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus glaucescens	Shield-bract Monkeyflower		Special	CRPR - 4.3
Mimulus guttatus	Common Large Monkeyflower			
Mimulus latidens	Broad-tooth Monkeyflower			
Mimulus pilosus				Not on any status lists
Mimulus tricolor	Tricolor Monkeyflower			
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Myriophyllum aquaticum	NA			
Najas gracillima	NA			
Najas guadalupensis guadalupensis	Southern Naiad			
Navarretia heterandra	Tehama Navarretia			
Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Panicum acuminatum acuminatum				Not on any status lists
Panicum dichotomiflorum	NA			
Paspalum distichum	Joint Paspalum			
Perideridia kelloggii	Kellogg's Yampah			

Persicaria hydropiper	NA			Not on any status lists
Persicaria hydropiperoides				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phyla lanceolata	Fog-fruit			
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys austiniae	Austin's Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pogogyne douglasii	NA			
Pogogyne zizyphoroides				Not on any status lists
Potamogeton diversifolius	Water-thread Pondweed			
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton nodosus	Longleaf Pondweed			
Potamogeton pusillus pusillus	Slender Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Ranunculus aquatilis aquatilis	White Water Buttercup			
Ranunculus aquatilis diffusus				Not on any status lists
Ranunculus hystriculus				Not on any status lists
Ranunculus pusillus pusillus	Pursh's Buttercup			
Ranunculus sardous	NA			
Ranunculus sceleratus	NA			
Rorippa palustris palustris	Bog Yellowcress			
Rotala ramosior	Toothcup			
Rumex conglomeratus	NA			
Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Sagittaria longiloba	Longbarb Arrowhead			

Sagittaria montevidensis calycina				Not on any status lists
Salix babylonica	NA			
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus mucronatus	NA			
Schoenoplectus tabernaemontani	Softstem Bulrush			
Sequoia sempervirens				
Sidalcea calycosa calycosa	Annual Checker-mallow			
Sidalcea hirsuta	Hairy Checker-mallow			
Spirodela polyrhiza	NA			
Stachys stricta	Sonoma Hedge-nettle			
Stuckenia pectinata				Not on any status lists
Symphyotrichum bracteolatum				Not on any status lists
Typha domingensis	Southern Cattail			
Typha latifolia	Broadleaf Cattail			
Utricularia macrorhiza	Greater Bladderwort			
Utricularia minor	Lesser Bladderwort		Special	CRPR - 4.2
Veronica anagallis-aquatica	NA			
Wolffia brasiliensis	Pointed Watermeal		Special	CRPR - 2B.3
Zannichellia palustris	Horned Pondweed			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

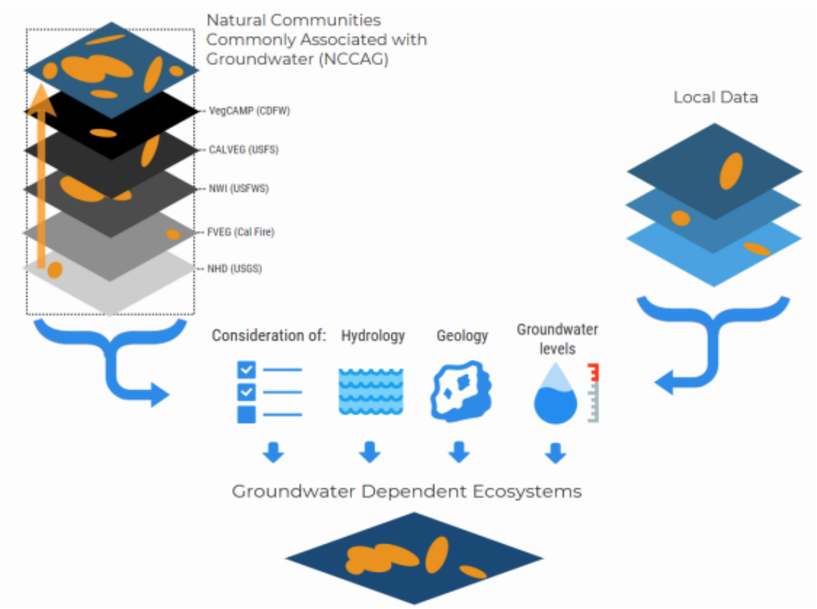


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

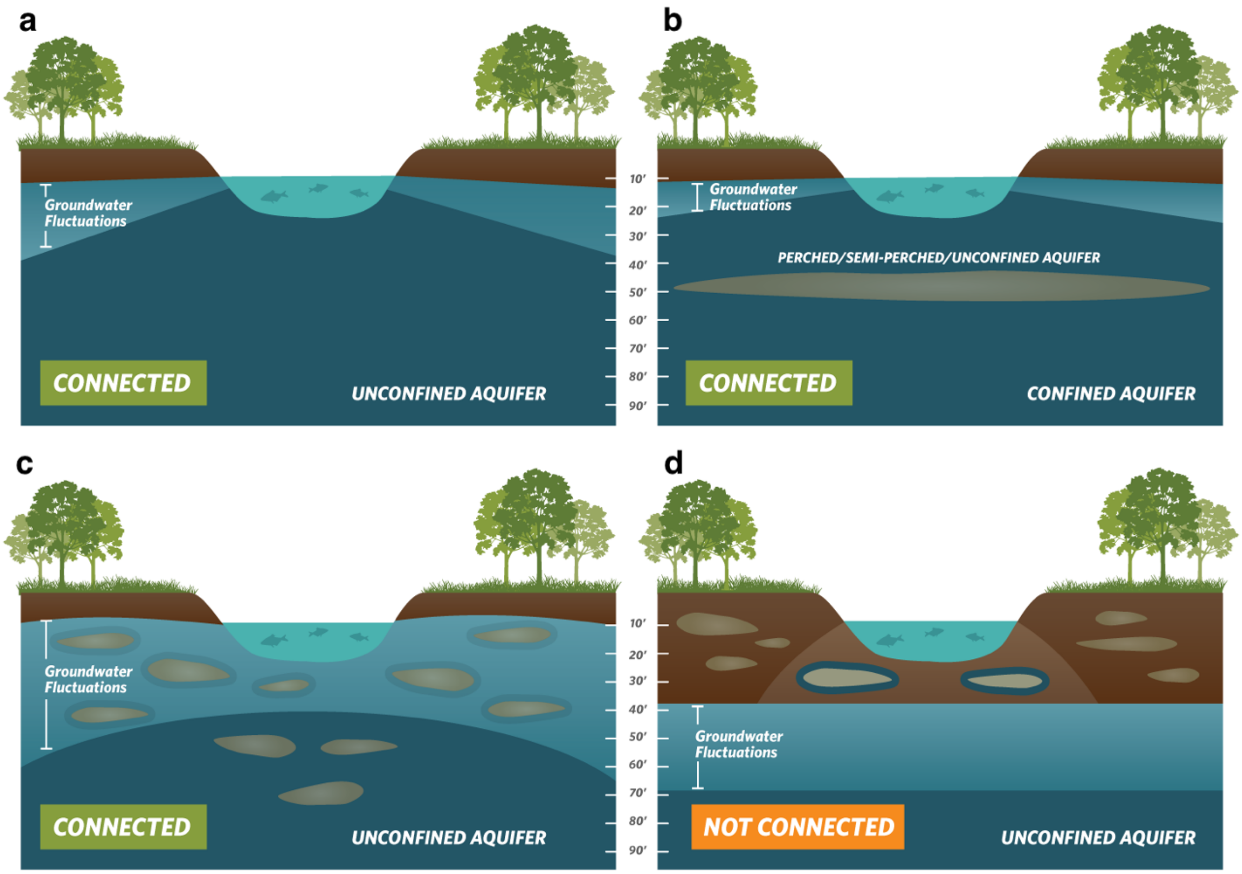


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

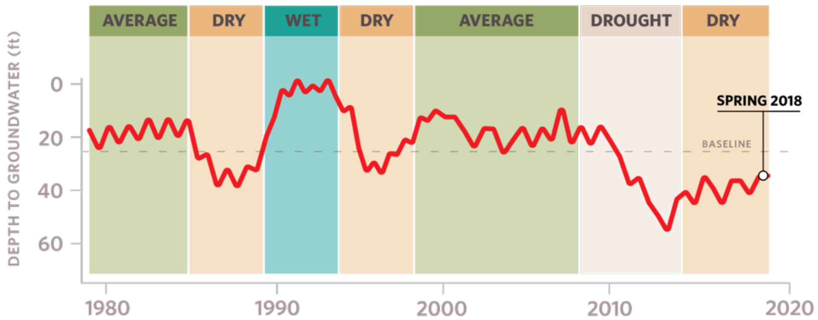


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

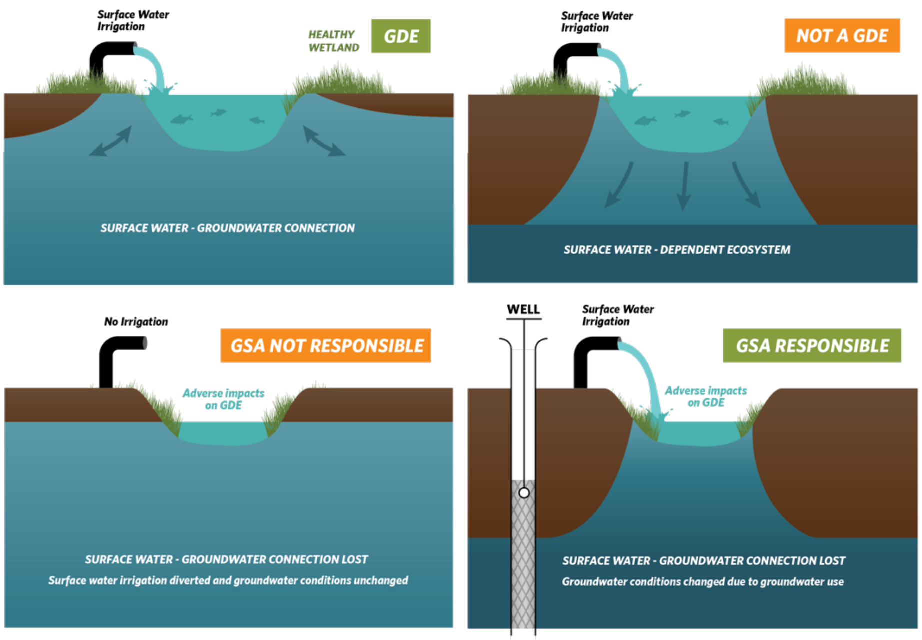

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

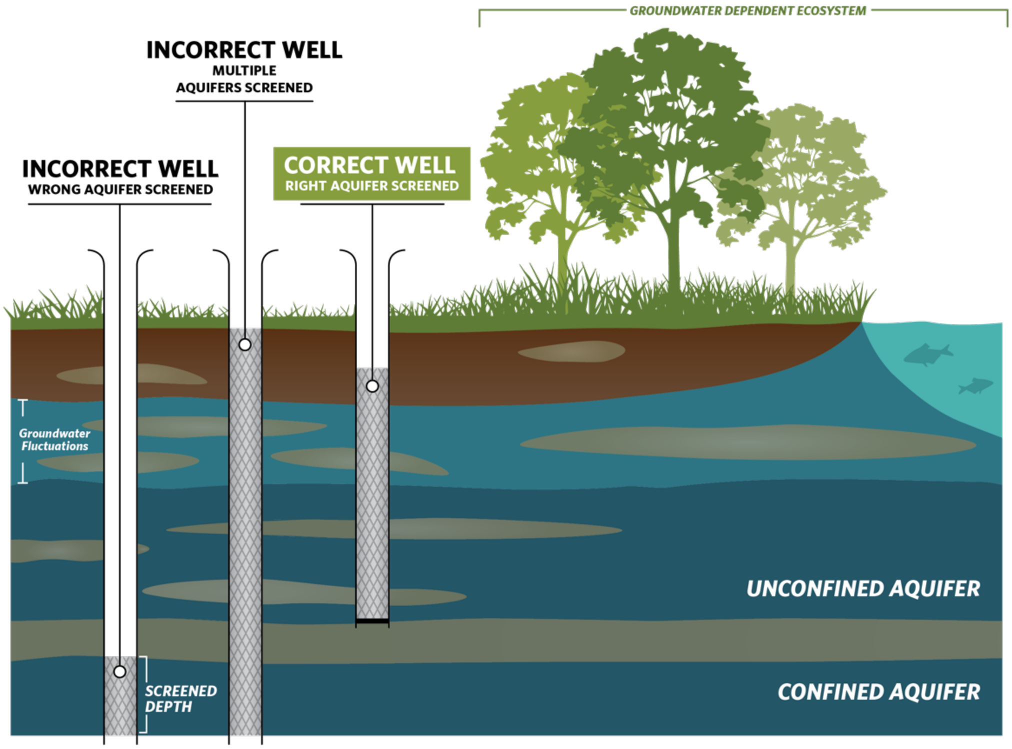

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

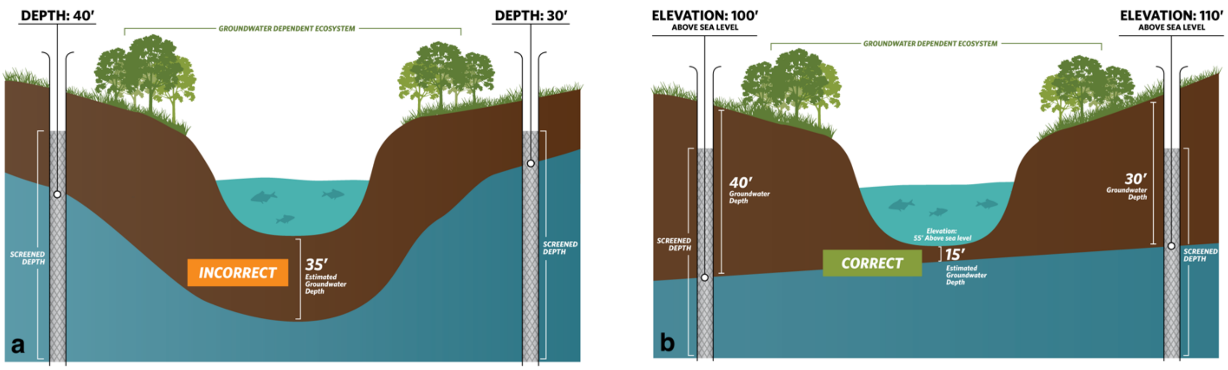

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

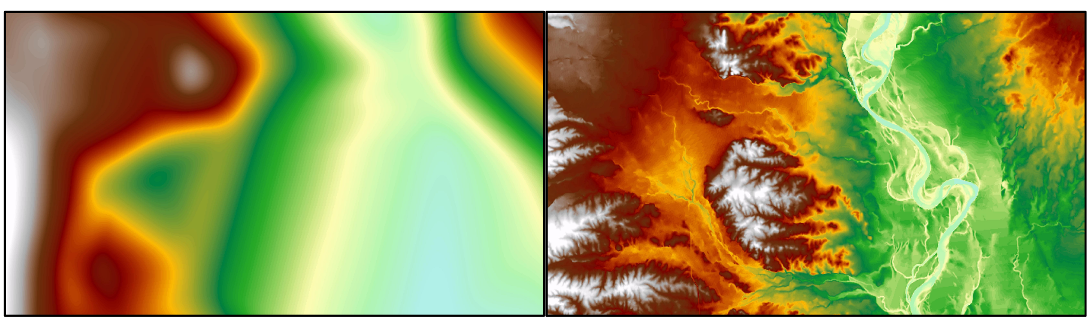

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

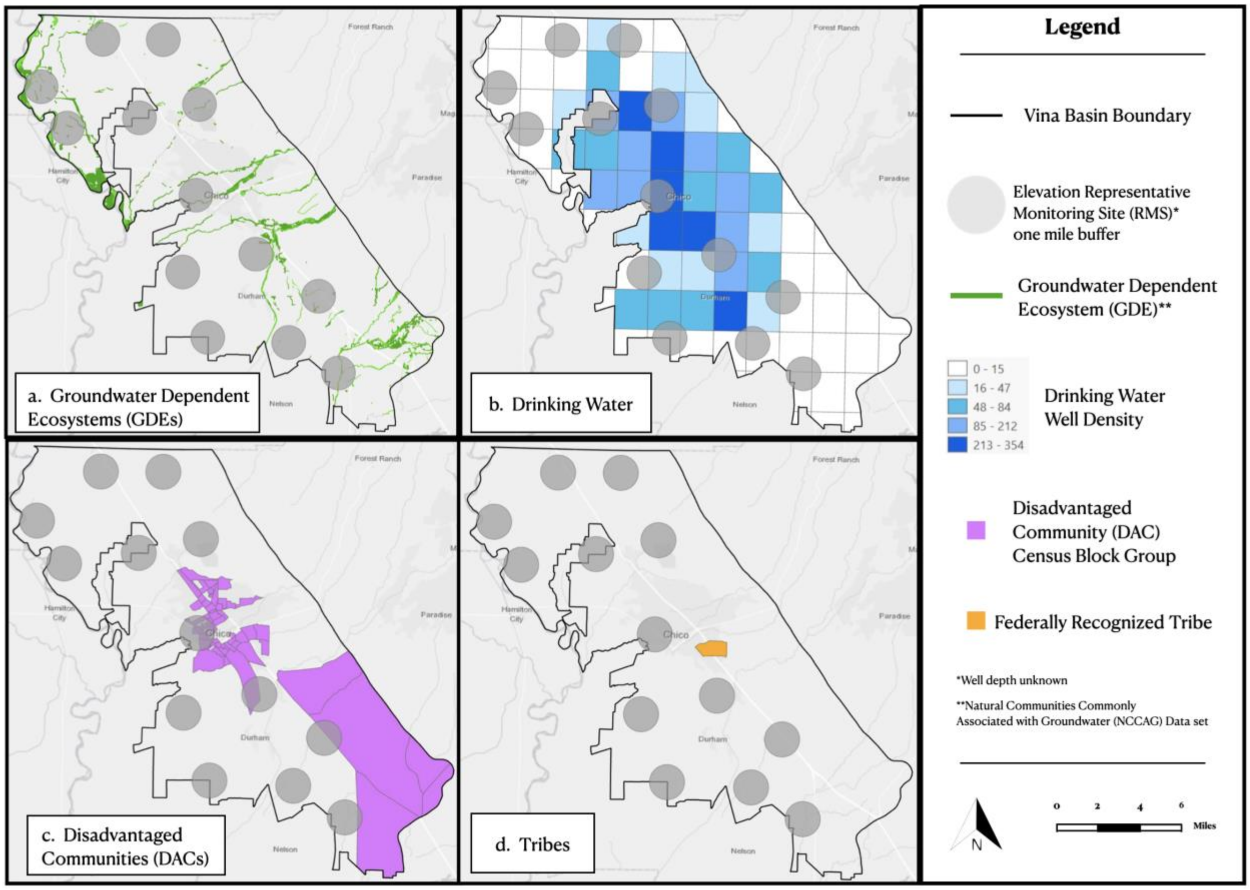

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

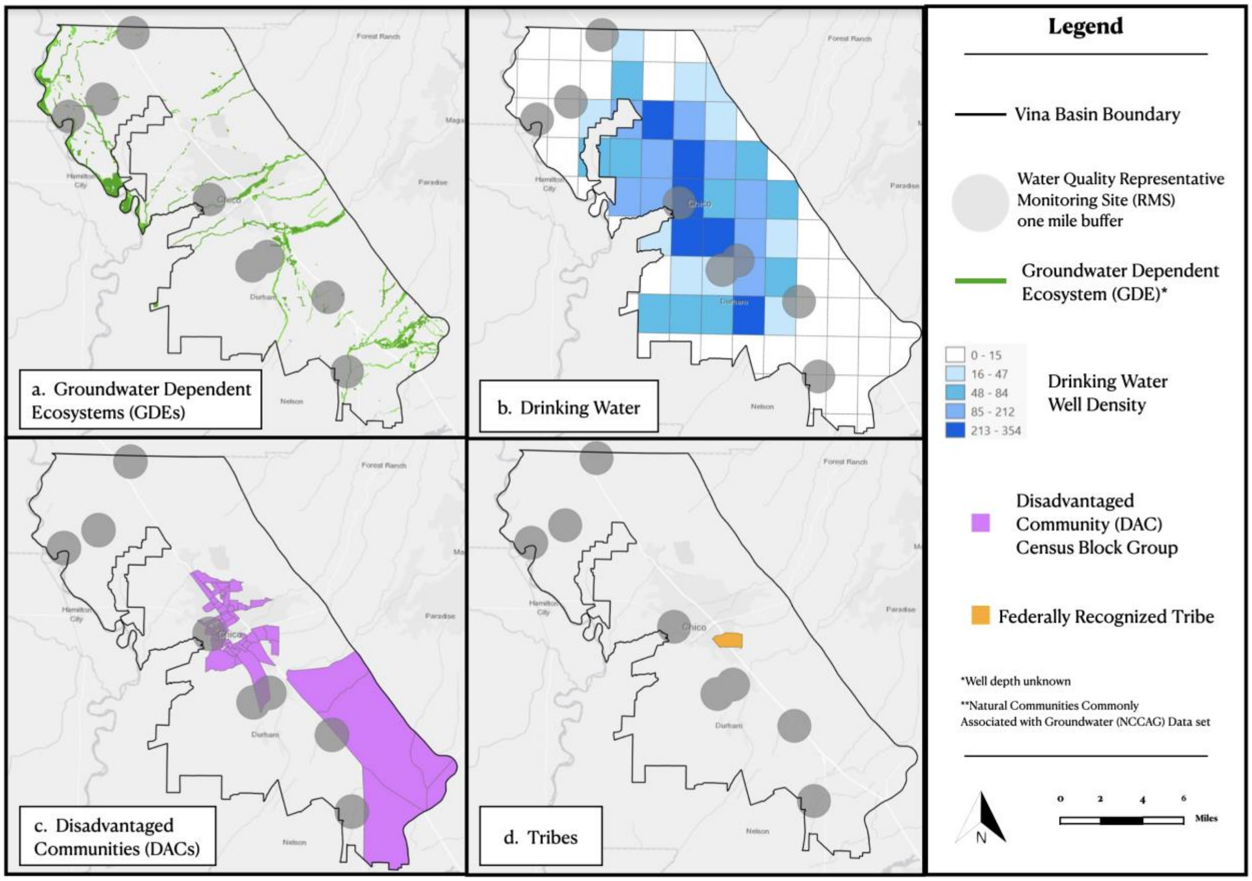

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

November 6, 2021

White Wolf GSA
4436 Lebec Road
Lebec, CA 93243

Submitted via email: amartin@tejonranch.com

Re: Public Comment Letter for White Wolf Subbasin Draft GSP

Dear Angelica Martin,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the White Wolf Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.

2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the White Wolf Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the White Wolf Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP provides information on DACs, including identification by name and location on a map (Figure PA-2), and identifies the population of each identified DAC. However, the GSP fails to include the population dependent on groundwater as their source of drinking water in the basin.

While the plan provides a density map of domestic wells in the basin (Figure PA-4), the GSP fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the basin. This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the basin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). • Include a map showing domestic well locations and average well depth across the basin.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP states (p. 87): *"As discussed above, groundwater levels in the Principal Aquifer are far below the land surface within most of the Basin (Figure GWC-4), and therefore there is no interconnected surface water throughout most of the Basin."* Figure GWC-4 presents point locations of average depth groundwater over the period 2015-2019. However, averaging depth to groundwater dampens the seasonal and interannual variability of these data. In California's Mediterranean climate, groundwater interconnections with surface water can vary seasonally and interannually. Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs.

The GSP discusses the ephemeral nature of the stream reaches as evidence that stream reaches are disconnected from groundwater. The GSP states (p. 87): *"Furthermore, the definition of interconnected surface water requires that the surface water feature not be completely depleted (i.e., not dry)."* However, this sentence is a misinterpretation of the regulations [23 CCR §351(o)], which define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

The GSA used the ICONS web mapping application as further evidence that ISWs are not present in the basin, stating that streams in the portion of the basin shown on this map are all designated as "likely disconnected". However, the ICONS web map data only covers a small portion of the basin.

Finally, the GSP states that the possible exception to the disconnected nature of groundwater and surface water in the basin is near the Springs Fault. The GSP states (p. 88): *"Furthermore, based on the available data (see Appendix D), water level data installed in co-located shallow monitoring wells show no impact from groundwater production from the Principal Aquifer. This suggests that this area is hydraulically disconnected from, and at a minimum should be managed separately from, the Principal Aquifer."* However, shallow aquifers that have the potential to support well development, support ecosystems, or provide baseflow to streams are principal aquifers, even if the majority of the basin's pumping is occurring in deeper principal aquifers.[2] If areas of shallow or perched groundwater are discounted as ISWs, the GSP should provide more supporting evidence of 1) vertical groundwater gradients between the perched system and deeper principal aquifers, and 2) whether perched groundwater is providing significant or economic quantities of water to streams, wells (e.g., domestic wells), and ecosystems (e.g., GDEs).

RECOMMENDATIONS
• Provide a map showing all the stream reaches in the basin, with reaches clearly labeled as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.

[2] "'Principal aquifers' refer to aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems." [23 CCR §351(aa)]

- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.

- Overlay the basin's stream reaches on depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis.

- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources. However, we found that mapped features in the NC dataset were improperly disregarded. NC dataset polygons were incorrectly removed based on the assumption that they are supported by a shallow water bearing zone separate from the regional aquifer (i.e., categories A and S on Figure GWC-18). However, shallow aquifers that have the potential to support well development, support ecosystems, or provide baseflow to streams are principal aquifers, even if the majority of the basin's pumping is occurring in deeper principal aquifers. If there are no data to characterize groundwater conditions in the shallow principal aquifer, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP.

The GSP presents depth-to-groundwater data on Figure GWC-17 (Natural Communities Commonly Associated with Groundwater and Spring 2015 Depth to Groundwater). This is the only dataset used to characterize groundwater conditions in the basin's GDEs. We recommend using groundwater data from multiple seasons and water year types to determine the range of depth to groundwater around NC dataset polygons.

Table GW-6 presents a rooting depth of 24 feet for Valley Oak (*Quercus lobata*). We recommend instead that an 80-foot depth-to-groundwater threshold be used when inferring whether Valley Oak polygons in the NC dataset are likely reliant on groundwater. This recommendation is based on a recent correction in TNC's rooting depth database,[3] after finding a typo in the max rooting depth units for Valley Oak. This resulted in a specific change in the max rooting depth of Valley Oak from 24 feet to 24 meters (80 feet).

RECOMMENDATIONS

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a pre-SGMA baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple

[3] TNC. 2021. Plant Rooting Depth Database. Available at: https://groundwaterresourcehub.org/sgma-tools/gde-rooting-depths-database-for-gdes/

water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30-ft threshold, such as Valley Oak (*Quercus lobata*). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether Valley Oak polygons from the NC Dataset are connected to groundwater. It is important to emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[4,5] The integration of native vegetation into the water budget is **sufficient**. We commend the GSA for including the groundwater demands of this ecosystem in the historical, current and projected water budgets. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATION

- State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Stakeholder Communication and Engagement Plan (Appendix B).[6]

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[4] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[5] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[6] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement during the GSP development and implementation phases are described in general terms. They include participation through stakeholder workshops, GSA Board meetings, distribution of a stakeholder survey, letters sent to the public water systems, development of fact sheets and newsletters, and updates to the GSA's website. The GSP states that DACs are engaged through use of the stakeholder survey and coordination with relevant community groups, but no further details are provided.

- While environmental stakeholders are listed as beneficial users within the basin, specific outreach and engagement targeted to this group is not described beyond informing stakeholders about the development process.

- Aside from the continuation of engagement strategies used during the GSP development process, the Stakeholder Communication and Engagement Plan does not include a detailed plan for continual opportunities for engagement through the *implementation* phase of the GSP that is specifically directed to DACs, domestic well owners, and environmental stakeholders.

RECOMMENDATIONS

- In the Stakeholder Communication and Engagement Plan, describe active and targeted outreach to engage DACs, domestic well owners, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the basin within the GSP.[7]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[8,9,10]

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[7] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[8] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[9] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[10] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, minimum thresholds are calculated as the lower of the following (p. 165): *"(a) the historic low groundwater level minus the Variability Correction Factor and (b) the groundwater level in Fall 2015 (i.e., the first Fall after SGMA went into effect) minus the greater of either the Variability Correction Factor or the Trend Continuation Factor."* Undesirable results are established as follows (p. 149): *"Undesirable Results for Chronic Lowering of Groundwater Levels would be experienced in the Basin if and when groundwater levels in the Principal Aquifer decline below the established MTs in 40% or more of the RMW-WLs over four consecutive seasonal measurements during non-drought years (i.e., measurements spanning a total of two non-drought years, including two seasonal high groundwater level periods and two seasonal low groundwater level periods)."* By only using 40% of minimum threshold exceedances in RMW-WLs during non-drought years to define undesirable results for groundwater levels, significant and unreasonable impacts to beneficial users experienced during dry years or periods of drought will not result in an undesirable result. This is problematic since the GSP is failing to manage the basin in such a way that strives to minimize significant adverse impacts to beneficial users, which are often felt greatest in below-average, dry, and drought years.

The GSP justifies these SMC based on a well impact analysis presented in Section 14.1.2. However, this analysis only assesses wells with available well construction information and wells that are newer than 50 years, under the assumption that the usable lifespan of groundwater wells is approximately 50 years. The GSP states that 78% of basin wells are greater than 50 years old, thereby neglecting most of the basin's wells from the well impact analysis. Given these criteria, only five wells in the domestic and public supply wells category (along with 24 wells in the irrigation category) could be analyzed. The GSP states (p. 167): *"The proposed MTs are not expected to result in complete dewatering in any of the wells analyzed, and are only expected to result in partial dewatering of four wells that were not already partially dewatered at the Fall 2015 groundwater elevation; as such, the extent of potential impacts is not considered to be significant and unreasonable."* Despite this well impact analysis, the GSP does not sufficiently describe whether minimum thresholds are consistent with California's Human Right to Water policy and will avoid significant and unreasonable loss of drinking water,[11] especially given the absence of a domestic well mitigation plan in the GSP.

In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs when defining undesirable results, nor does it describe how the groundwater level minimum thresholds are consistent with Human Right to Water policy and will avoid significant and unreasonable impacts on DACs.

For degraded water quality, minimum thresholds are set for arsenic, nitrate, and selenium at their respective MCLs. The GSP states (p. 171): *"Several other constituents (i.e., Total Dissolved Solids (TDS), sulfate, iron, boron, and sodium) were identified in Section 8.5 Groundwater Quality Concerns as having exceeded their applicable screening levels in 15% or more of samples in the White Wolf Data Management System (DMS). However, the screening levels for these constituents are mostly Secondary MCLs associated with aesthetic concerns (i.e., taste, odor or color) or irrigation Water Quality Objectives (WQOs), and are not health-related standards. Because these constituents are not expected to have significant impacts to the most sensitive beneficial use of groundwater in the Basin (i.e., drinking water), SMCs have not been developed for those constituents."* However, according to the state's anti-degradation policy,[12]

[11] California Water Code §106.3. Available at:
https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3
[12] Anti-degradation Policy
https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf

high water quality should be protected and is only allowed to worsen if a finding is made that it is in the best interest of the people of the State of California. No analysis has been done and no such finding has been made. SMC should be established for all constituents in the basin that are impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Consider minimum threshold exceedances during drought years when defining the groundwater level undesirable result across the basin.

- In the well impact assessment, utilize well data from older wells (>50 years old) to better represent minimum threshold impacts to wells across the basin.

- Describe direct and indirect impacts on DACs and drinking water users when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.

Degraded Water Quality

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to “Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act.”[13]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users.

- Set minimum thresholds and measurable objectives for all water quality constituents within the basin that are impacted by groundwater use and/or management. Ensure they align with drinking water standards.[14]

- Set minimum thresholds that do not allow water quality to degrade to levels at or above the MCL trigger level.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP only considers GDEs with respect to the depletion of interconnected surface water sustainability indicator, but not the chronic lowering of groundwater levels sustainability indicator. No analysis or discussion is provided in the GSP that describes impacts to GDEs or establishes SMC for GDEs that are directly dependent on groundwater. This is problematic because without identifying potential impacts to GDEs, minimum thresholds may compromise these environmental beneficial users. Since GDEs are present in the basin, they must be considered when developing

[13] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[14] “Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues.” [23 CCR §354.34(c)(4)]

SMC for chronic lowering of groundwater levels. Our comments above in the GDE section note that the GDE analysis may have disregarded some GDEs in the basin which could be directly dependent on groundwater, including deeper-rooted plants such as Valley Oak.

For depletion of interconnected surface water, the GSP uses groundwater elevations as a proxy for establishing SMC. The GSP states (p. 156): *"Significant and unreasonable effects associated with Undesirable Results would include a 30% reduction of, or visual impact to, the health of GDEs based on their conditions observed during 2018 through 2020 that can be directly attributed to Principal Aquifer pumping-related lowering of groundwater levels rather than the effects of natural or climatic processes."* The GSA has established preliminary minimum thresholds for interconnected surface water at three newly installed shallow monitoring wells, which are the representative monitoring wells for depletions of ISW. The minimum thresholds are set as follows (p. 176): *"Using the above values, the initial MT estimates at each RMW-ISW location are calculated as the lower of the following: (a) the projected depth to groundwater at the end of October 2021 calculated based on observed June 2021 water levels and the Trend Continuation Factor, and (b) 30 ft bgs."* While the GSP recognizes that there could be impacts on terrestrial GDEs through its definition of significant and unreasonable effects, no further details on these impacts are provided, such as which habitat types could be affected, or the anticipated physiological responses based on minimum threshold groundwater levels. The GSP should also evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the basin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration). Furthermore, the GSP should describe how SMC for depletion of interconnected surface water will be updated once more data is gathered from the newly installed monitoring wells.

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the basin.[15] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[16]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the basin are reached.[17] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected

[15] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[16] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[17] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,18]

- When establishing SMC for the basin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[19] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[20] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the basin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

The GSP includes climate change into key inputs (e.g., precipitation, evapotranspiration, and surface water flow) of the projected water budget, and calculates a sustainable yield based on the projected water budget with climate change incorporated. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

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[18] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[19] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

[20] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

RECOMMENDATIONS
• Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions. • Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Wells (RMWs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs and domestic wells in the basin.

Figure MN-1 (SGMA Monitoring Network for Chronic Lowering of Groundwater Levels) shows insufficient representation of DACs for groundwater elevation monitoring. Figure MN-2 (SGMA Monitoring Network for Degraded Water Quality) shows insufficient representation of DACs and drinking water users for water quality monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater (note we were only able to prepare groundwater elevation monitoring maps with information from the Draft GSP). These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[21]

RECOMMENDATIONS
• Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify monitored areas. • Increase the number of RMWs in the shallow aquifer across the basin as needed to map ISWs and adequately monitor all groundwater condition indicators across the basin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMWs. • Ensure groundwater elevation and water quality RMWs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs. • Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the basin.

[21] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

While Section 18.2.1.3 documents several projects to expand in-lieu recharge, the GSP fails to describe the projects' explicit benefits or impacts to beneficial users, including the environment and DACs. The plan also fails to include a domestic well mitigation program to avoid significant and unreasonable loss of drinking water. We strongly recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

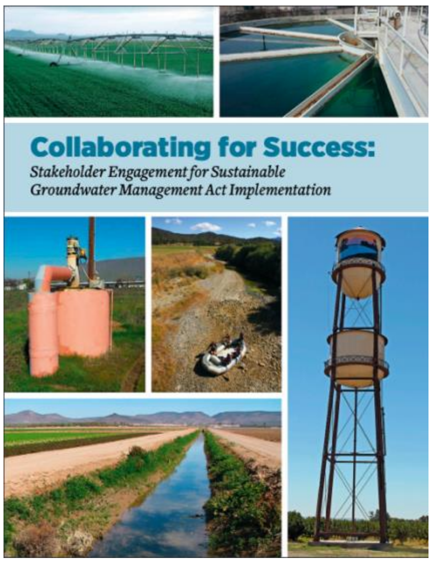
- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For further guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[22]

- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[22] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B
SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



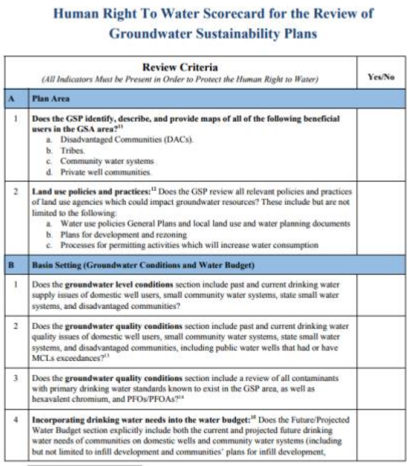
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

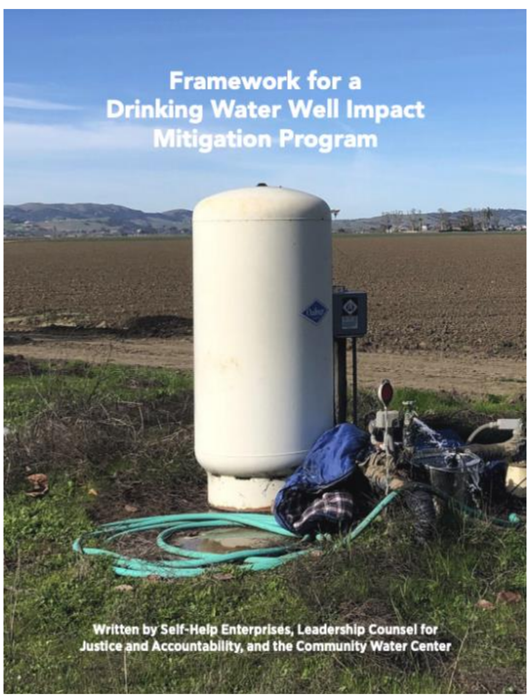


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

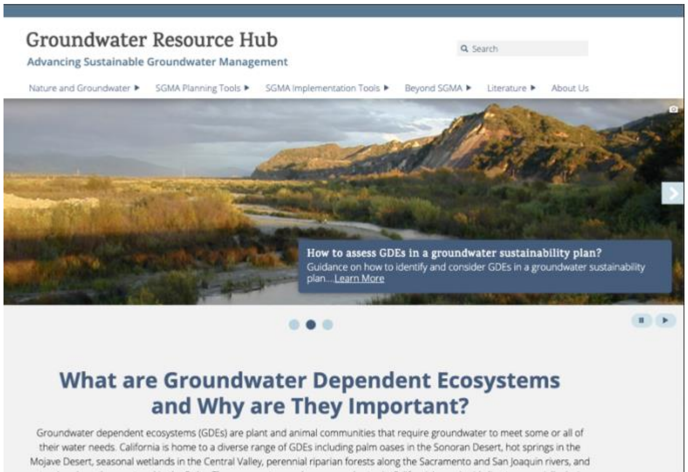
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



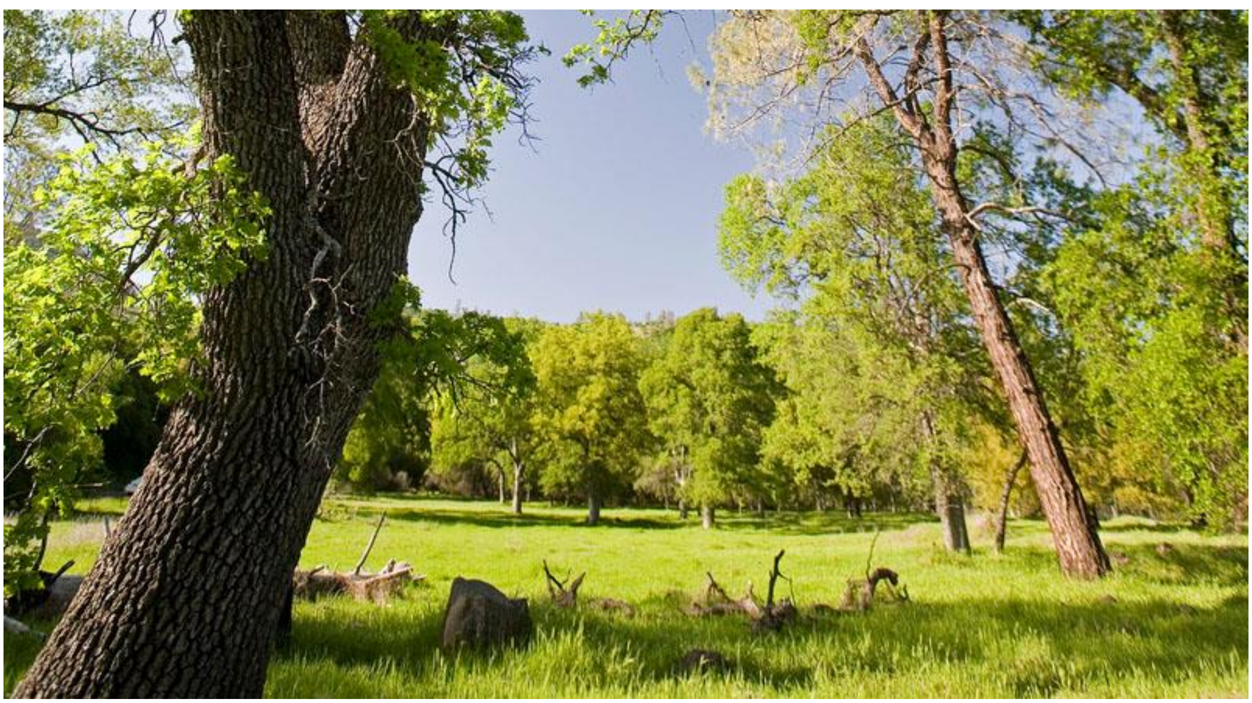
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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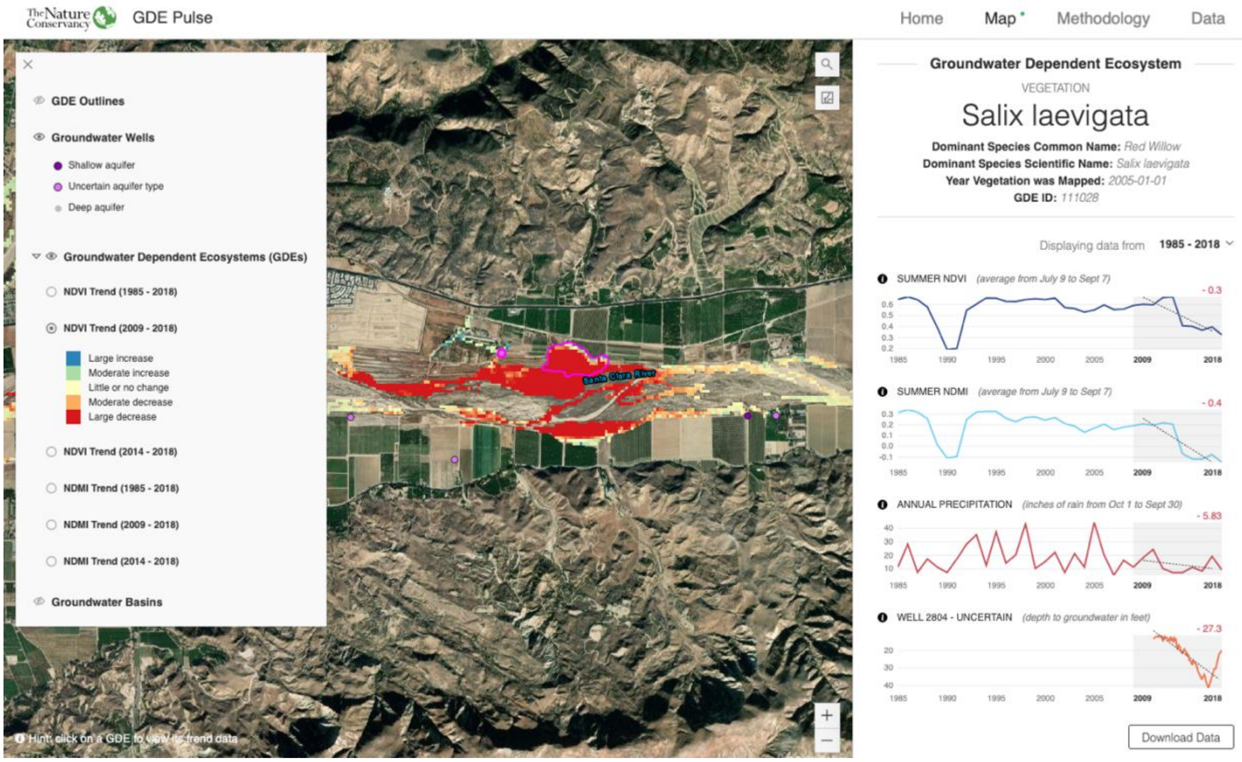
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

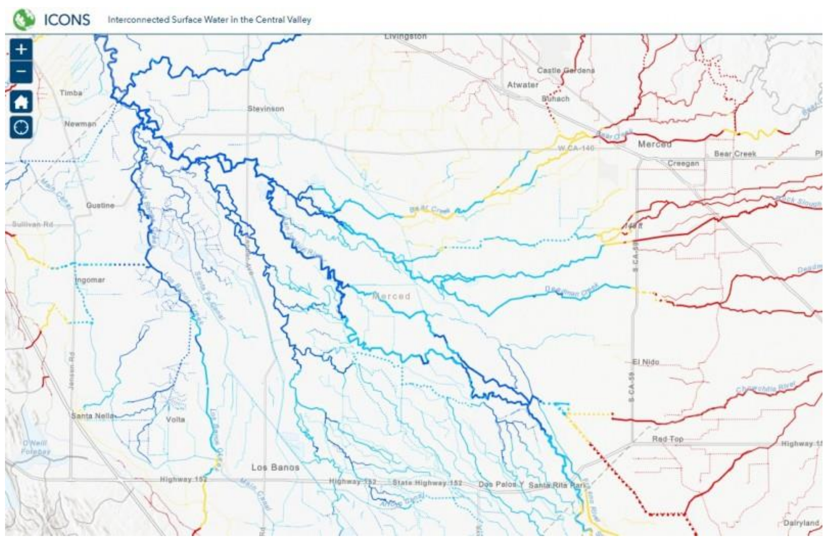
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the White Wolf Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the White Wolf Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas crecca	Green-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya valisineria	Canvasback		Special	
Bucephala albeola	Bufflehead			
Cistothorus palustris palustris	Marsh Wren			
Egretta thula	Snowy Egret			
Fulica americana	American Coot			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Oxyura jamaicensis	Ruddy Duck			
Phalacrocorax auritus	Double-crested Cormorant			
Plegadis chihi	White-faced Ibis		Watch list	
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Tachycineta bicolor	Tree Swallow			
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis sirtalis sirtalis	Common Gartersnake			
PLANTS				
Alnus rhombifolia	White Alder			
Ammannia coccinea	Scarlet Ammannia			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla filiculoides	NA			
Azolla microphylla	Mexican mosquito fern		Special	CRPR - 4.3
Baccharis salicina				Not on any status lists
Berula erecta	Wild Parsnip			
Bidens laevis	Smooth Bur-marigold			
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Bolboschoenus robustus				Not on any status lists
Callitriche marginata	Winged Water-starwort			
Carex alma	Sturdy Sedge			
Carex densa	Dense Sedge			
Carex lasiocarpa	Slender Sedge		Special	CRPR - 2B.3

Carex pellita	Woolly Sedge			
Carex senta	Western Rough Sedge			
Castilleja miniata miniata	Greater Red Indian-paintbrush			
Castilleja minor minor	Alkali Indian-paintbrush			
Cephalanthus occidentalis	Common Buttonbush			
Cicuta douglasii	Western Water-hemlock			
Cirsium crassicaule	Slough Thistle		Special	CRPR - 1B.1
Cirsium scariosum scariosum	Drummond's Thistle			Not on any status lists
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Cyperus erythrorhizos	Red-root Flatsedge			
Datisca glomerata	Durango Root			
Downingia bella	Hoover's Downingia			
Downingia pulchella	Flat-face Downingia			
Echinodorus berteroi	Upright Burhead			
Eleocharis bella	Delicate Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Eleocharis parishii	Parish's Spikerush			
Epilobium oregonense	Oregon Willow-herb			
Epipactis gigantea	Giant Helleborine			
Euthamia occidentalis	Western Fragrant Goldenrod			
Helenium bigelovii	Bigelow's Sneezeweed			
Helenium puberulum	Rosilla			
Iris missouriensis	Western Blue Iris			
Isolepis cernua	Low Bulrush			
Juncus acutus leopoldii	Spiny Rush		Special	CRPR - 4.2
Juncus dubius	Mariposa Rush			
Juncus macrandrus	Long-anther Rush			
Juncus macrophyllus	Longleaf Rush			
Juncus textilis	Basket Rush			
Juncus xiphioides	Iris-leaf Rush			
Lasthenia ferrisiae	Ferris' Goldfields		Special	CRPR - 4.2
Lemna gibba	Inflated Duckweed			
Lemna minuta	Least Duckweed			
Limosella aquatica	Northern Mudwort			
Lythrum californicum	California Loosestrife			
Marsilea vestita vestita	NA			Not on any status lists
Myosurus minimus	NA			
Myriophyllum aquaticum	NA			

Navarretia intertexta	Needleleaf Navarretia			
Paspalum distichum	Joint Paspalum			
Perideridia parishii latifolia	Parish's Yampah			
Perideridia parishii parishii	Parish's Yampah		Special	CRPR - 2B.2
Perideridia pringlei	Pringle's Yampah		Special	CRPR - 4.3
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria pensylvanica	NA			Not on any status lists
Phacelia distans	NA			
Phalaris arundinacea	Reed Canarygrass			
Phragmites australis australis	Common Reed			
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Platanthera sparsiflora sparsiflora	Canyon Bog Orchid			
Platanus racemosa	California Sycamore			
Pluchea odorata odorata	Scented Conyza			
Pluchea sericea	Arrow-weed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus tenellus	NA			
Puccinellia simplex	Little Alkali Grass			
Rhododendron occidentale occidentale	Western Azalea			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rorippa palustris palustris	Bog Yellowcress			
Rumex conglomeratus	NA			
Rumex salicifolius salicifolius	Willow Dock			
Salix exigua exigua	Narrowleaf Willow			
Salix exigua hindsiana				Not on any status lists
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus americanus	Three-square Bulrush			
Schoenoplectus pungens pungens	NA			
Scirpus microcarpus	Small-fruit Bulrush			

Sesbania herbacea				Not on any status lists
Sidalcea neomexicana	Rocky Mountain Checker-mallow		Special	CRPR - 2B.2
Sphenosciadium capitellatum	Swamp Whiteheads			
Stachys albens	White-stem Hedge-nettle			
Typha domingensis	Southern Cattail			
Veronica americana	American Speedwell			
Veronica anagallis-aquatica	NA			
Veronica catenata	NA			Not on any status lists
Zannichellia palustris	Horned Pondweed			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

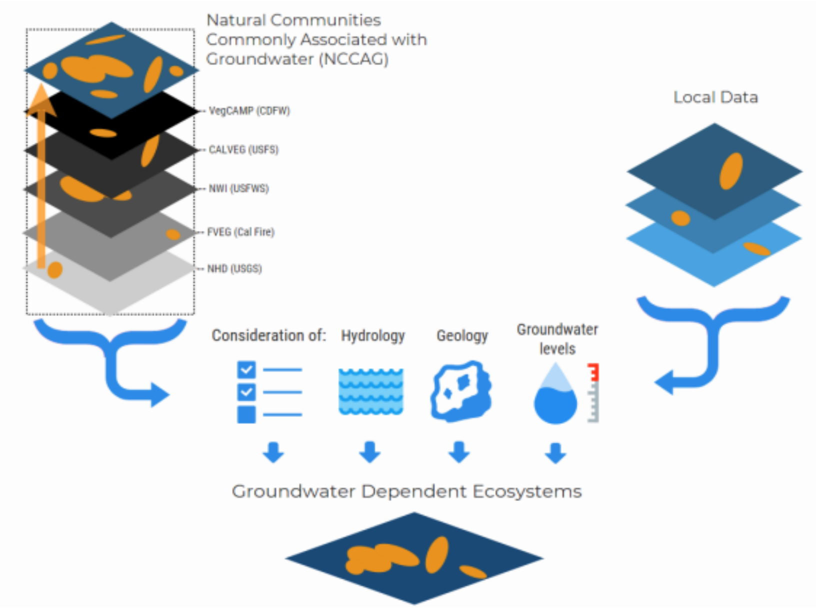


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

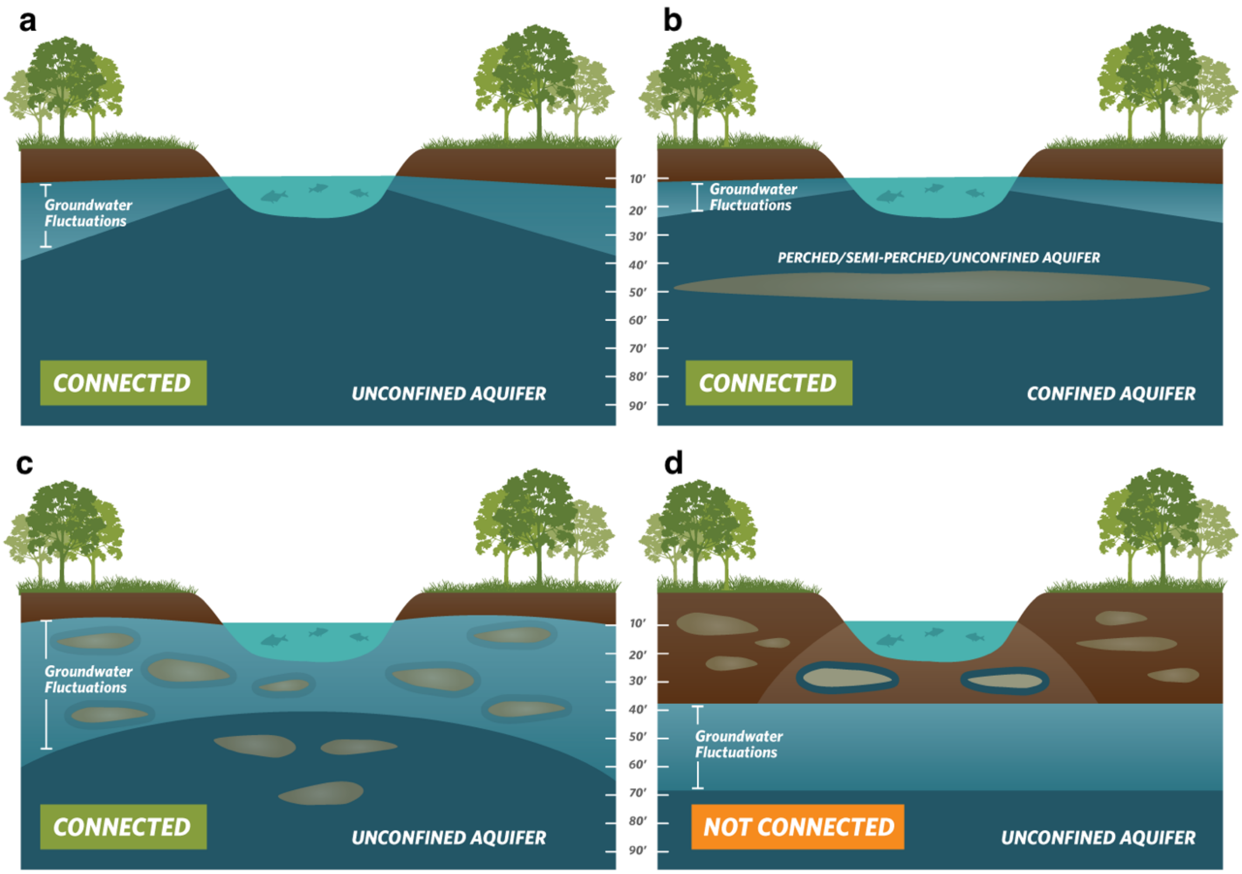

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

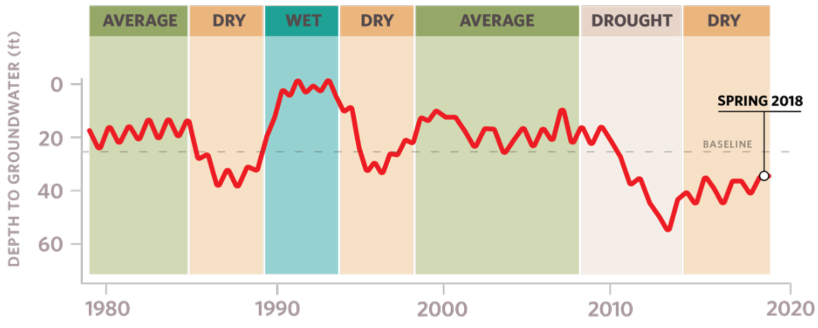

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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6 DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

7 Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

8 Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

9 SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

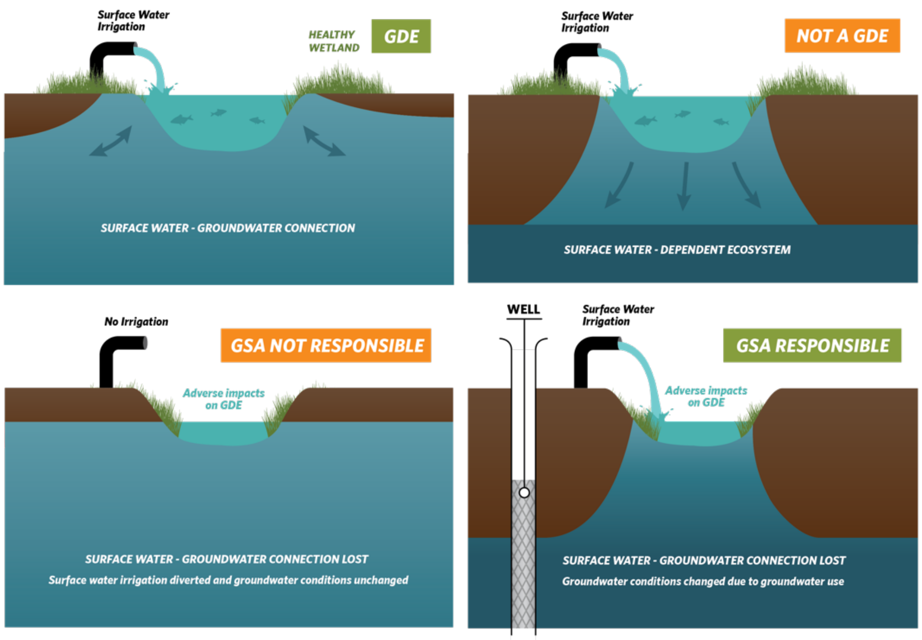

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

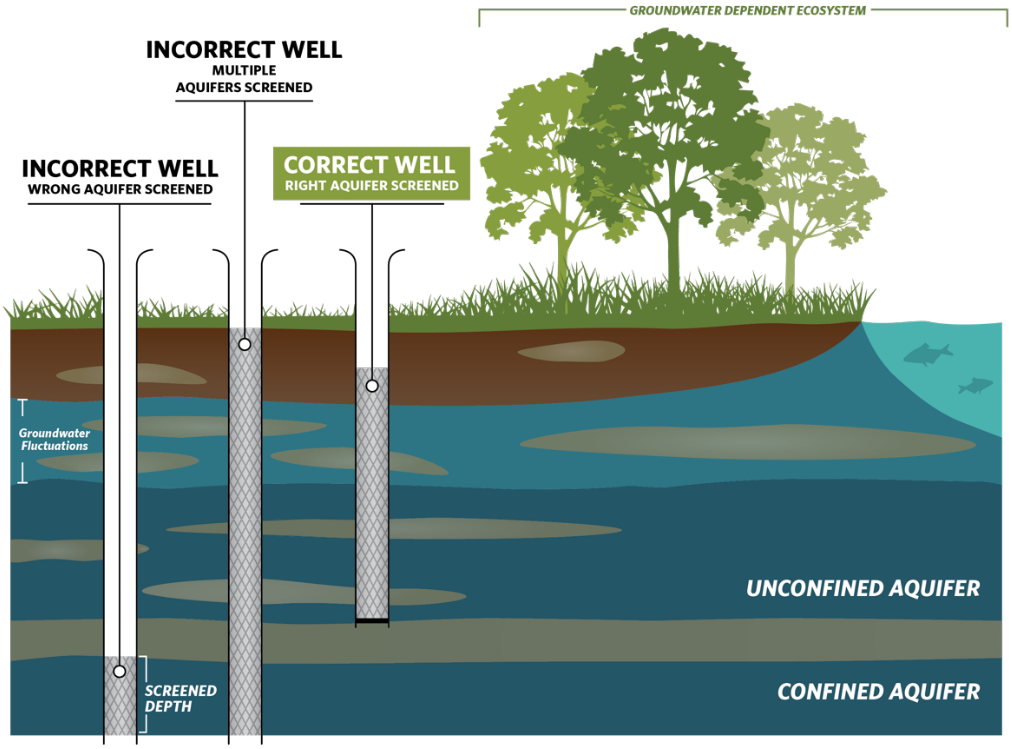

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

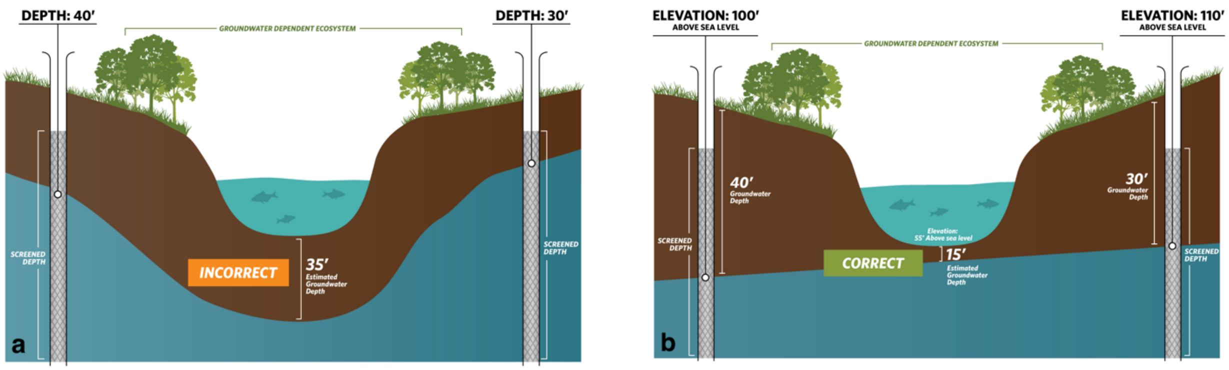

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

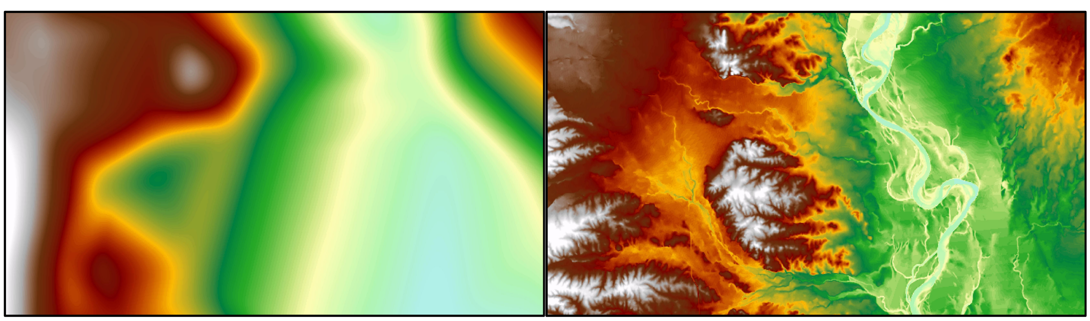

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

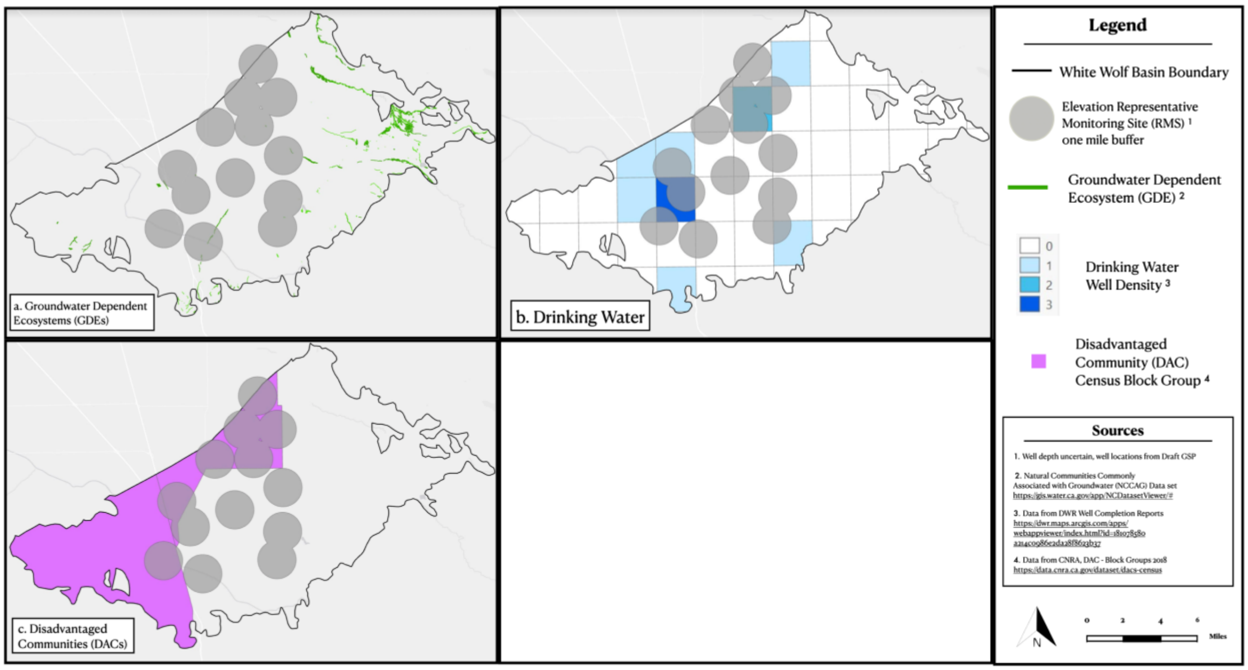

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

October 24, 2021

Wyandotte Creek GSA
308 Nelson Avenue
Oroville, CA 95965

Submitted via email: wyandottegsa@gmail.com

Re: Public Comment Letter for Wyandotte Creek Groundwater Subbasin Draft GSP

Dear Christina Buck,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Wyandotte Creek Groundwater Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.

2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Wyandotte Creek Groundwater Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Wyandotte Creek Groundwater Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. We note the following deficiencies with the identification of these key beneficial users.

- The GSP provides information on DACs, including identification by name and location on a map, but fails to provide the population of each DAC within the subbasin.
- The GSP fails to provide a map of tribal lands within the subbasin.
- While the GSP provides a map of domestic well density in Figure 1-9, the plan does not provide the depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.
- The GSP fails to identify the population dependent on groundwater as their source of drinking water in the subbasin. Specifics are not provided on how much each DAC community relies on a particular water supply (e.g., what percentage is supplied by groundwater).

These missing elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide the population of each identified DAC. Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

- Provide a map of tribal lands within the subbasin.
- Include a map showing domestic well locations and average well depth across the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP describes use of the BBGM (Butte Basin Groundwater Model), however does not present a thorough description of the data used in the model, such as the groundwater level monitoring well data and stream gauge data that were incorporated into the model. Additionally, no description was provided of the temporal (seasonal and interannual) variability of the data used to calibrate the model. This information should be provided in the GSP to support the conclusions presented.

The GSP states (p. 46): *"Based on consideration of the frequency with which stream segments are gaining based on BBGM results and on consideration of the spring depth to groundwater below the estimated streambed depth along each primary stream, it is likely that all streams traversing or bounding the subbasin are connected to the groundwater system."* Figure 2-20 presents a map of stream reaches in the subbasin, showing the percentage of months of either a gaining or losing condition in the subbasin as predicted by the BBGM model. We recommend that the reaches are also labeled as interconnected, so that it is clear that all stream segments are retained as ISWs in the GSP.

RECOMMENDATIONS

- Label stream reaches on Figure 2-20 as interconnected (gaining/losing), to make clear that all stream segments are retained as ISWs in the GSP.
- Further describe the groundwater elevation data and stream flow data used in the BBGM analysis.
- To confirm and illustrate the results of the groundwater modeling, overlay the stream reaches shown on Figure 2-20 with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis.
- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.
- Describe data gaps for the ISW analysis in the ISW section, in addition to the discussion in the monitoring network section (4.10 Network Assessment and Improvements).

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP does not discuss how the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) was verified with the use of groundwater data from the shallow aquifer. Without an analysis of groundwater data to verify the NC dataset polygons, it will be difficult or impossible to adequately monitor and manage the subbasin's GDEs throughout GSP implementation.

The GSP took initial steps to identify and map GDEs using the NC dataset and other sources. However, we found that some mapped features in the NC dataset were improperly disregarded. NC dataset polygons were incorrectly removed in areas adjacent to irrigated fields or due to the presence of surface water supplies. However, this removal criteria is flawed since GDEs, in addition to groundwater, can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields – simultaneously and at different temporal/spatial scales. NC dataset polygons adjacent to irrigated land or surface water supplies can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to irrigated fields or surface water.

The GSP did not discuss the flora or fauna species present in the subbasin's GDEs, except to acknowledge the presence of Valley oak (*Quercus lobata*) in the subbasin. We commend the GSA for retaining all Valley oak polygons in the NC dataset based on the recognition that they can access groundwater at deeper depths.

RECOMMENDATIONS

- Provide a comprehensive set of maps for the subbasin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained, removed, or added to/from the NC dataset (include the removal reason if polygons are not considered potential GDEs, or include the data source if polygons are added). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network. It is not clear from the description in the GSP whether NC dataset polygons labeled as 'Not Likely a GDE' on Figure 2-23 are retained as potential GDEs.

- Include an inventory of the fauna and flora present within the subbasin's GDEs (see Attachment C of this letter for a list of freshwater species located in the Wyandotte Creek Subbasin). Note any threatened or endangered species.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of these ecosystems into the water budget is **sufficient** because the groundwater demands of native vegetation and managed wetlands are included in the historical, current, and projected water budgets. Additional clarification is needed on the managed wetland acres represented in the basin water budget to ensure all managed wetlands are captured. DWR's Statewide Crop Mapping layer is one spatial dataset that indicates managed wetland extent.

RECOMMENDATION

- Provide documentation of the managed wetland acres and associated evapotranspiration values that are used as inputs in the water budget model (BCDWRC 2021).

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Communication and Engagement Plan (Appendix 1-C).[4]

The Communication and Engagement Plan documents representation of tribal and environmental interests on the Wyandotte Creek Advisory Committee (WAC). However, we note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement with DACs and drinking water users are described in very general terms, including attending GSA Board and public meetings, WAC meetings, public workshops, subbasin-wide Technical Advisory Committee meetings, Farm Bureau Water Forum meetings, City of Oroville meetings, and Regional Water Management Group meetings. No specific outreach targeted to DACs and drinking water users is described in the GSP, nor does the GSP document how feedback from stakeholders was incorporated into the GSP development.

[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- The Communication and Engagement Plan does not include a specific plan with details for continual opportunities for engagement through the *implementation* phase of the GSP for DACs, drinking water users, tribes, and environmental stakeholders.

RECOMMENDATIONS
• In the Communication and Engagement Plan, describe active and targeted outreach to engage DACs, drinking water users, environmental stakeholders and consultation to tribes through the GSP development *and* implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. • Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the subbasin within the GSP.[5]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users
For chronic lowering of groundwater levels, the GSP discusses minimum threshold impacts on domestic wells (see Section 3.3.2 Minimum Thresholds). The GSP states (p. 88): "*In recent years, Butte County has documented a number of domestic wells that have gone dry, meaning groundwater levels have fallen below the depth of the well installation and/or pump throughout the County. This occurred during summer months of recent drought years and heightened concern among some stakeholders. As a result, domestic well reliability and protection are the focus of the Groundwater Levels MT*."

The plan states that *"the quantitative Wyandotte Creek Subbasin Undesirable Result for the Chronic Lowering of Groundwater Levels occurs when: two RMS wells within a management area reach their MT for two consecutive non-dry year-types."* This information suggests that minimum thresholds reached during dry years or periods of drought will not result in an undesirable result.

The GSP also discusses the use of the DWR domestic well database and sets minimum threshold levels protective of domestic wells by establishing a representative zone for each RMS

[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf
[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

well. The resulting minimum thresholds are protective of 85% of domestic wells. Despite this well impact analysis, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users in those 15% of wells not protected by the MT, and whether the undesirable results are consistent with California's Human Right to Water policy.[9]

The GSP does not, however, sufficiently describe or analyze direct or indirect impacts on DACs, drinking water users or tribes when defining undesirable results, nor does it describe how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results to DACs and tribes in the subbasin.

For degraded water quality, salinity is the only constituent of concern (COC) for which SMC are established in the subbasin. The minimum threshold is set to the upper limit of the Secondary Maximum Contaminant Level (SMCL) for specific conductance based on the state secondary drinking water standards. The GSP states (p. 93): "*Other constituents, as discussed in Section 2.2.4, are managed through existing management and regulatory programs within the Subbasin, such as the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) and the Irrigated Lands Regulatory Program (ILRP), which focus on improving water quality by managing septic and agricultural sources of salinity and nutrients. Additionally, point-source contaminants are managed and regulated through a variety of programs by the Regional Water Quality Control Board (RWQCB), Department of Toxic Substances Control (DTSC), and the U.S. Environmental Protection Agency (EPA).*" However, SMC should be established for all COCs in the subbasin including chemicals of emerging concern (CEC) impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

The GSP only includes a very general discussion of impacts on drinking water users when defining undesirable results and evaluating the impacts of proposed minimum thresholds for water quality. The GSP does not, however, mention or discuss direct and indirect impacts on DACs or tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs or tribes.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users, DACs and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels including dry years and periods of drought.

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[10]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3
[10] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

- Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management. Ensure they align with drinking water standards.[11]

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts to GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC for chronic lowering of groundwater levels.

The GSP recognizes a data gap with respect to the interconnected surface water SMC. The GSP states (p. 98): *"The GSA intends to further evaluate this SMC to avoid undesirable results to aquatic ecosystems and GDEs. To that end, an Interconnected Surface Water SMC framework has been developed for the GSP as described below. This framework will guide future data collection efforts to fill data gaps, either as part of GSP projects and management actions or plan implementation."*

While the data gap is being filled, the SMC for depletion of interconnected surface waters are established by proxy using groundwater levels. The GSP states (p. 99): *"Therefore, at this time, Groundwater Levels SMC are used by proxy and the MT for interconnected surface water is the same as for groundwater levels: Two RMS wells within a management area reach their MT for two consecutive non-dry year-types."* However, no analysis or discussion is presented to describe how the SMC will affect GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- Define chronic lowering of groundwater SMC directly for environmental beneficial users of groundwater. When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in

[11] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

the subbasin.[12] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[13]

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[14] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,15]

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[16] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[17] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower

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[12] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[13] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[14] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]
[15] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf
[16] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]
[17] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

The GSP incorporates climate change into key inputs (e.g., precipitation and evapotranspiration) of the projected water budget. However, imported water should be adjusted for climate change and clearly incorporated into the surface water flow inputs of the projected water budget. Furthermore, the GSP does not provide a sustainable yield based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of projected climate change effects on imported water inputs, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.

- Incorporate climate change into surface water flow inputs, including imported water, for the projected water budget.

- Estimate sustainable yield based on the projected water budget with climate change incorporated.

- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, tribes, GDEs, and ISWs in the subbasin.

Figure 4-5 (Groundwater Level RMS Wells) and Figure 4-6 (Water Quality RMS Wells) show that no monitoring wells are located across portions of the subbasin near DACs, domestic wells, and tribes (see maps we've provided in Attachment E). Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[18]

The GSP provides some discussion of data gaps for GDEs and ISWs in Sections 4.10 (Network Assessment and Improvements) and Section 6.1.3 (Data Analysis), however, does not provide specific plans, such as locations or a timeline, to fill the data gaps.

[18] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, tribes, GDEs, and ISWs to clearly identify potentially impacted areas.
- Increase the number of RMSs in the shallow aquifer across the subbasin as needed to adequately monitor all groundwater condition indicators across the basin and at appropriate depths. Prioritize proximity to DACs, domestic wells, tribes, and GDEs when identifying new RMSs.
- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient** due to the failure to completely identify impacts to water quality from projects and management actions. Additionally, the proposed recharge projects, such as Flood MAR (Section 5.3.4), do not list explicit benefits to DACs within the subbasin. Potential project and management actions may not protect beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

We commend the GSA for including projects and management actions with explicit benefits to the environment (e.g., Oroville Wildlife Area Robinson's Riffle Project, Streamflow Augmentation, Removal of Invasive Species). We also commend the GSA for including the domestic well mitigation program described in Section 5.3.2, with stated priority for disadvantaged communities who are dependent on groundwater.

RECOMMENDATIONS

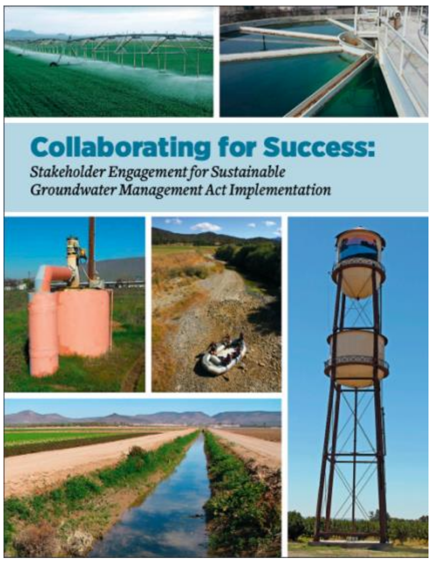
- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.
- The GSP discusses recharge projects in Section 5.2.4 (Planned Projects). Note that recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For further guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[19]
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[19] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

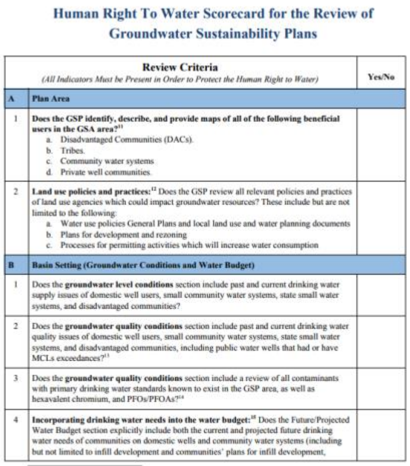
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

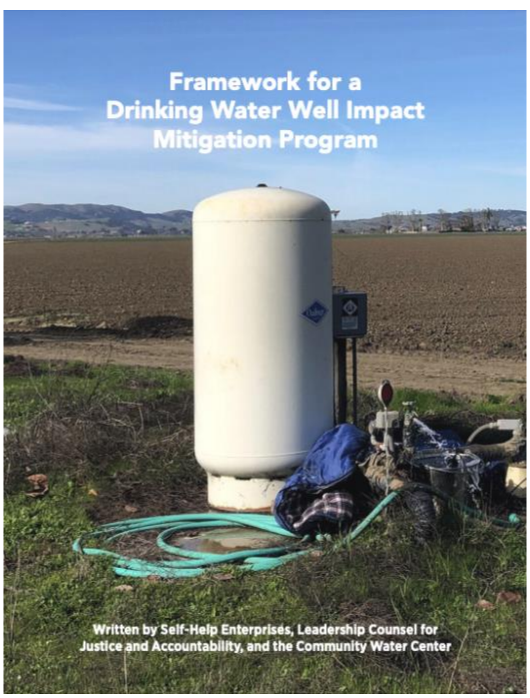


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

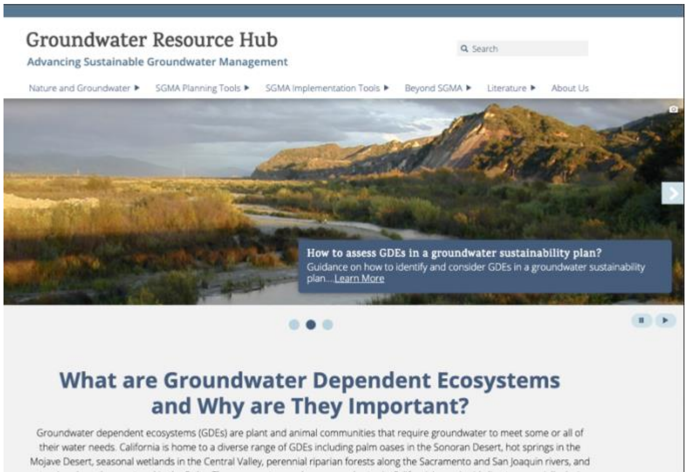
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



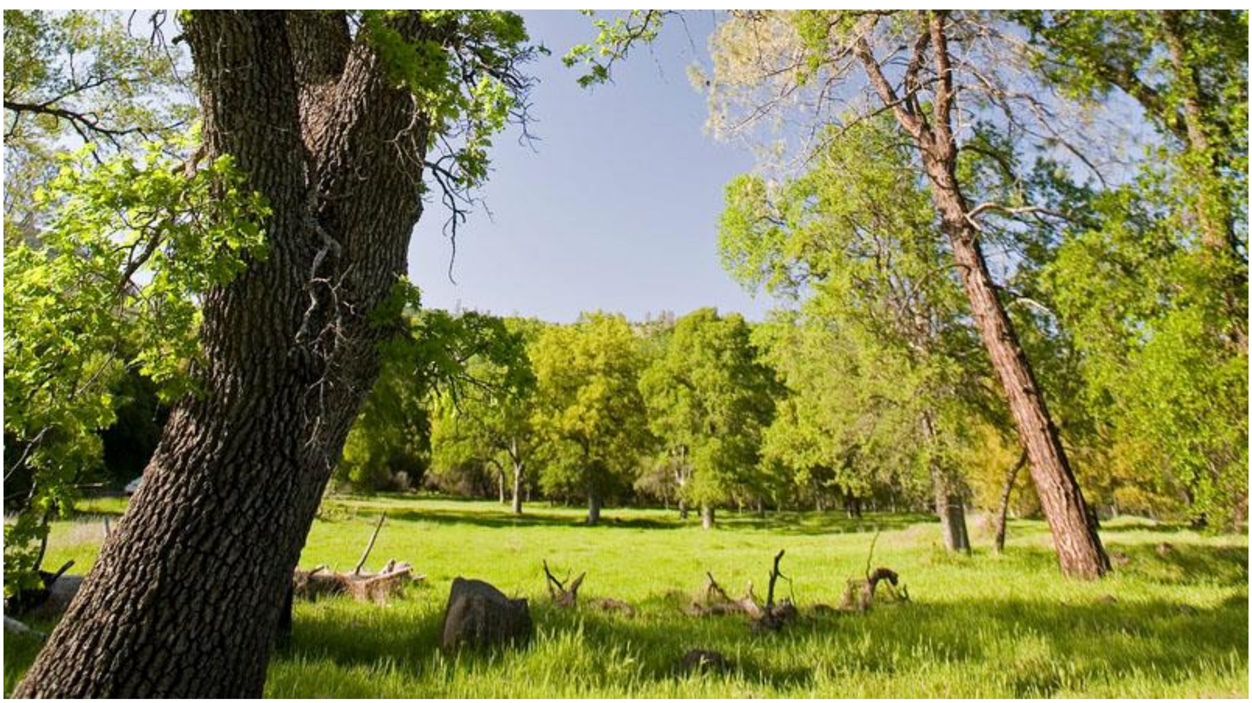
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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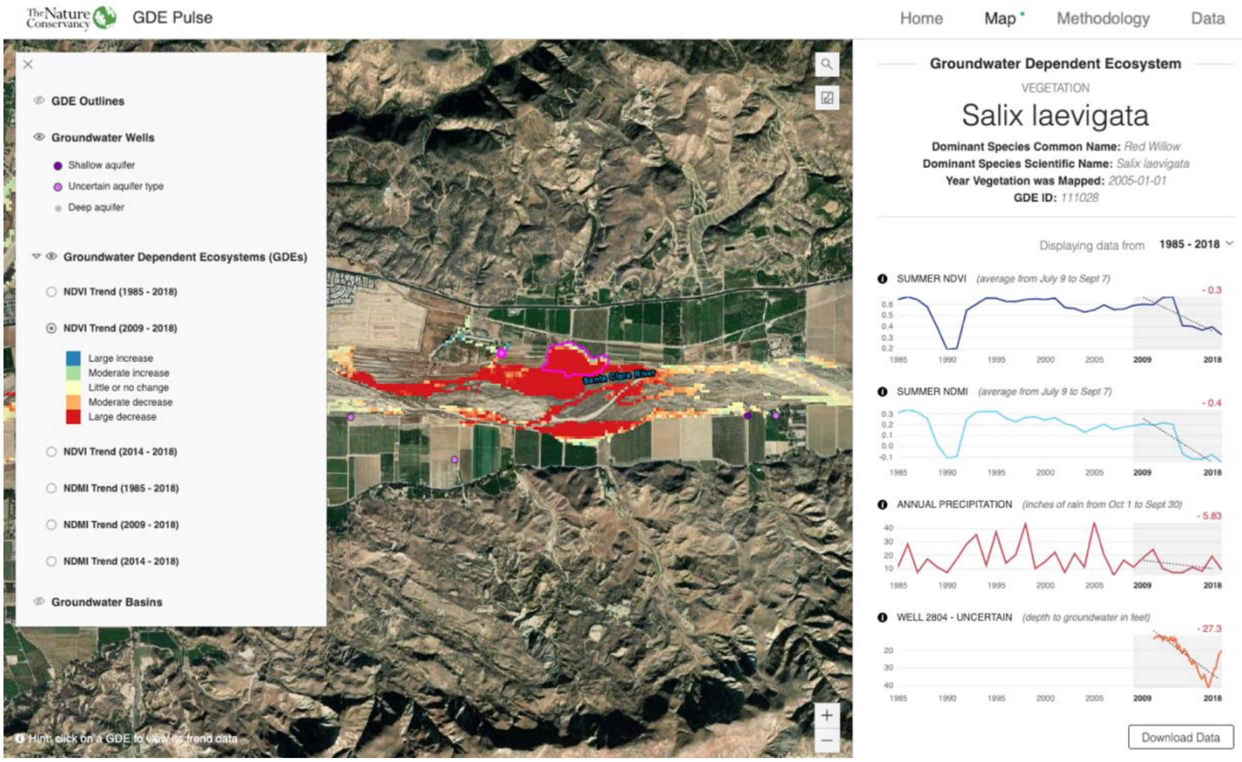
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

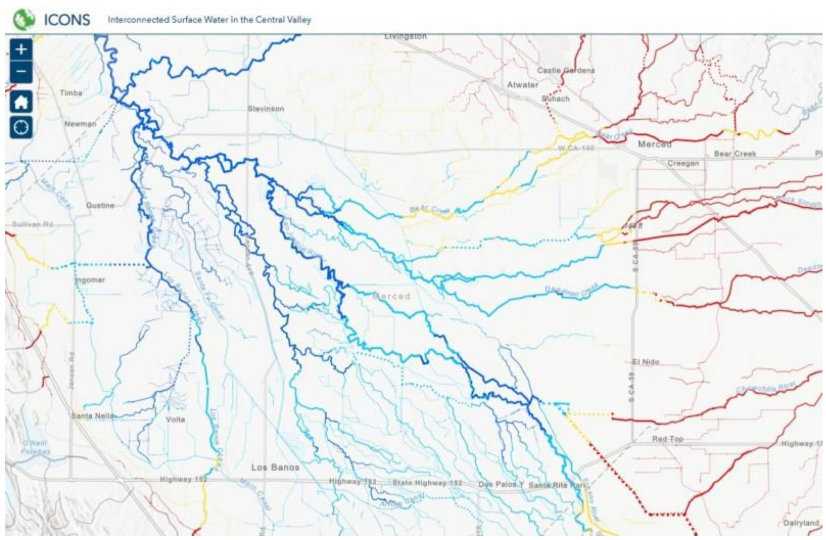
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Wyandotte Creek Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Wyandotte Creek Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	**State**	**Other**
BIRDS				
Riparia riparia	Bank Swallow		Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Butorides virescens	Green Heron			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Plegadis chihi	White-faced Ibis		Watch list	
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
FISH				

Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Capnia quadrituberosa	Four-knobbed Snowfly			
Argia emma	Emma's Dancer			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Enallagma cyathigerum				Not on any status lists
Gyrinus affinis				Not on any status lists
Ischnura cervula	Pacific Forktail			
Ischnura perparva	Western Forktail			
Libellula saturata	Flame Skimmer			
Plathemis lydia	Common Whitetail			
Sympetrum corruptum	Variegated Meadowhawk			
Tramea lacerata	Black Saddlebags			
Zoniagrion exclamationis	Exclamation Damsel			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists

MOLLUSKS				
Margaritifera falcata	Western Pearlshell		Special	
PLANTS				
Orcuttia tenuis	Slender Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Alisma triviale	Northern Water-plantain			
Alopecurus carolinianus	Tufted Foxtail			
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Ammannia robusta	Grand Redstem			
Arundo donax	NA			
Azolla filiculoides	NA			
Bacopa rotundifolia	NA			
Bergia texana	Texas Bergia			
Bolboschoenus glaucus	NA			Not on any status lists
Brodiaea nana				Not on any status lists
Callitriche heterophylla heterophylla	Northern Water-starwort			
Callitriche marginata	Winged Water-starwort			
Callitriche trochlearis	Waste-water Water-starwort			
Carex densa	Dense Sedge			
Carex feta	Green-sheath Sedge			
Carex vulpinoidea	NA			
Ceratophyllum demersum	Common Hornwort			
Cicendia quadrangularis	Oregon Microcala			
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Cyperus bipartitus	Shining Flatsedge			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus flavescens	NA			
Downingia bella	Hoover's Downingia			
Downingia bicornuta	NA			
Downingia ornatissima	NA			
Echinodorus berteroi	Upright Burhead			
Elatine californica	California Waterwort			
Elatine heterandra	Mosquito Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis acicularis occidentalis				Not on any status lists
Eleocharis atropurpurea	Purple Spikerush			
Eleocharis bella	Delicate Spikerush			
Eleocharis engelmannii engelmannii	Engelmann's Spikerush			Not on any status lists
Eleocharis macrostachya	Creeping Spikerush			

Eleocharis obtusa	Blunt Spikerush			
Eleocharis quadrangulata	NA			
Eleocharis quinqueflora	Few-flower Spikerush			
Eleocharis radicans	Rooted Spikerush			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium articulatum	Jointed Coyote-thistle			
Euthamia occidentalis	Western Fragrant Goldenrod			
Gratiola ebracteata	Bractless Hedge-hyssop			
Hydrocotyle umbellata	Many-flower Marsh-pennywort			
Isoetes howellii	NA			
Isoetes nuttallii	NA			
Isolepis cernua	Low Bulrush			
Juncus acuminatus	Sharp-fruit Rush			
Juncus articulatus articulatus				Not on any status lists
Juncus diffusissimus	NA			
Juncus effusus pacificus				
Juncus uncialis	Inch-high Rush			
Juncus usitatus	NA			Not on any status lists
Landoltia punctata	NA			Not on any status lists
Lasthenia fremontii	Fremont's Goldfields			
Limnanthes alba alba	White Meadowfoam			
Limnanthes douglasii douglasii	Douglas' Meadowfoam			
Limosella acaulis	Southern Mudwort			
Limosella aquatica	Northern Mudwort			
Lipocarpha micrantha	Dwarf Bulrush			
Ludwigia hexapetala	NA			Not on any status lists
Ludwigia palustris	Marsh Seedbox			
Ludwigia peploides montevidensis	NA			Not on any status lists
Lycopus americanus	American Bugleweed			
Lythrum portula	NA			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Myosurus minimus	NA			
Myriophyllum aquaticum	NA			
Navarretia leucocephala leucocephala	White-flower Navarretia			

Panicum dichotomiflorum	NA			
Paspalum distichum	Joint Paspalum			
Perideridia kelloggii	Kellogg's Yampah			
Persicaria hydropiper	NA			Not on any status lists
Persicaria hydropiperoides				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria punctata	NA			Not on any status lists
Pilularia americana	NA			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Pogogyne douglasii	NA			
Pogogyne zizyphoroides				Not on any status lists
Psilocarphus brevissimus multiflorus	Delta Woolly Marbles		Special	CRPR - 4.2
Psilocarphus oregonus	Oregon Woolly-heads			
Ranunculus bonariensis	NA			
Ranunculus pusillus pusillus	Pursh's Buttercup			
Ranunculus sceleratus	NA			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rotala ramosior	Toothcup			
Sagittaria montevidensis calycina				Not on any status lists
Salix exigua hindsiana				Not on any status lists
Salix gooddingii	Gooding's Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Stachys pycnantha	Short-spike Hedge-nettle			
Stuckenia pectinata				Not on any status lists
Typha latifolia	Broadleaf Cattail			
Wolffia borealis	Dotted Watermeal			
Wolffia globosa	Asian Watermeal			
Zizania palustris interior	NA			
Zizania palustris palustris	NA			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

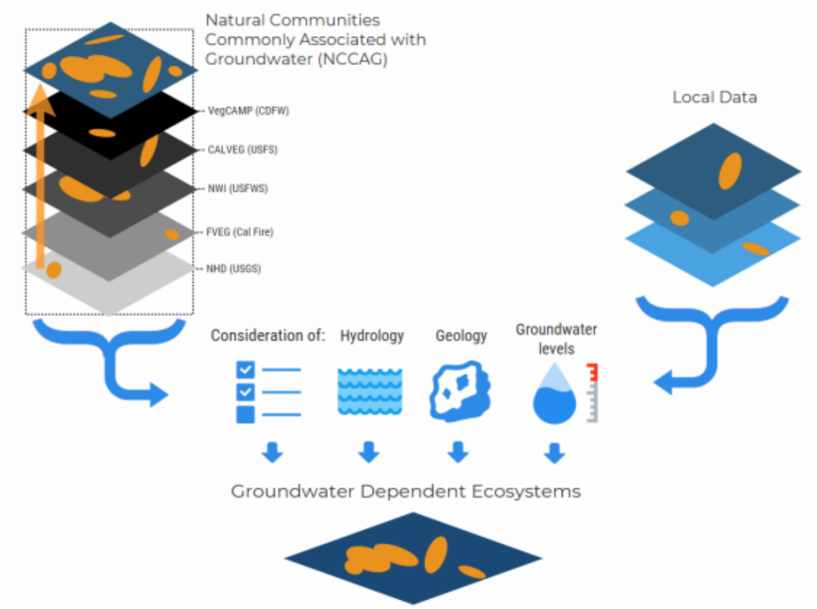


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

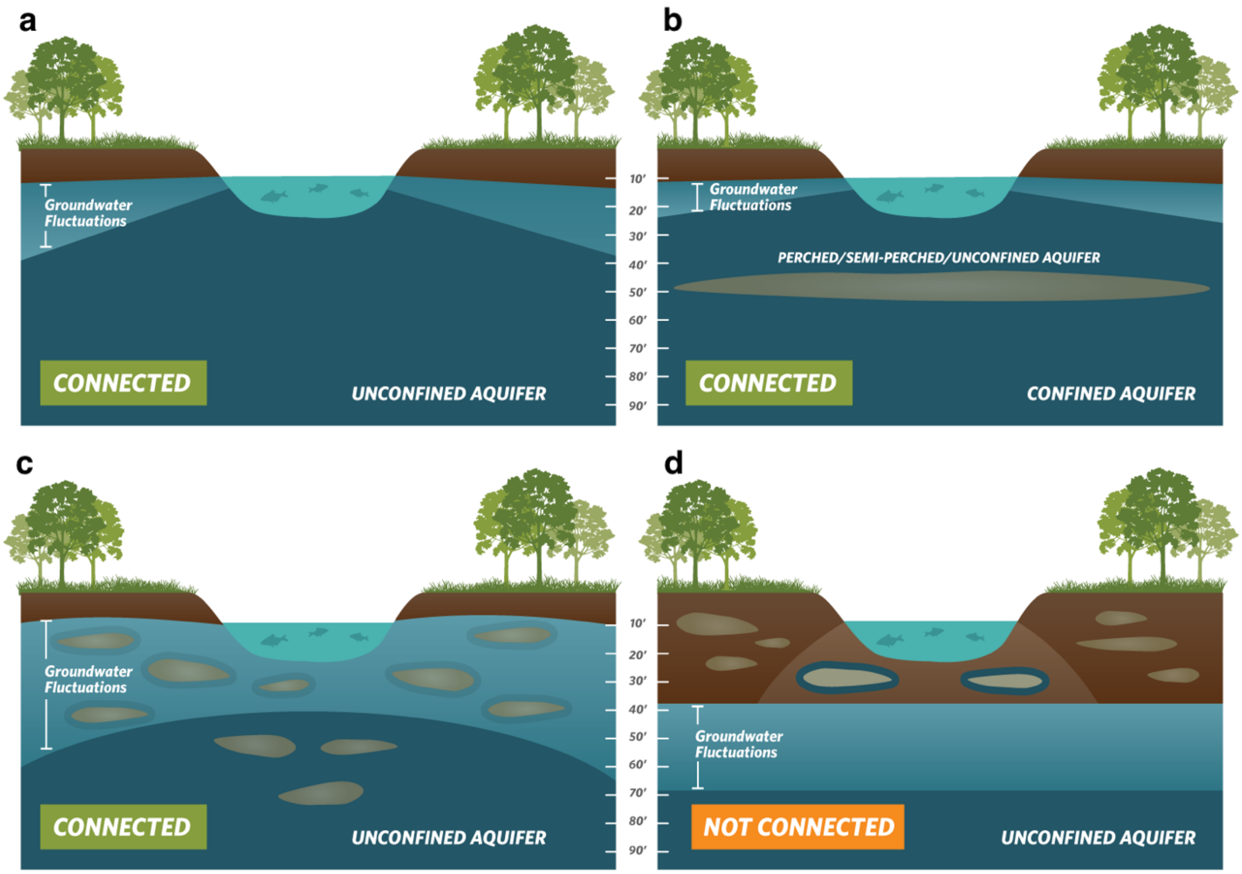

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

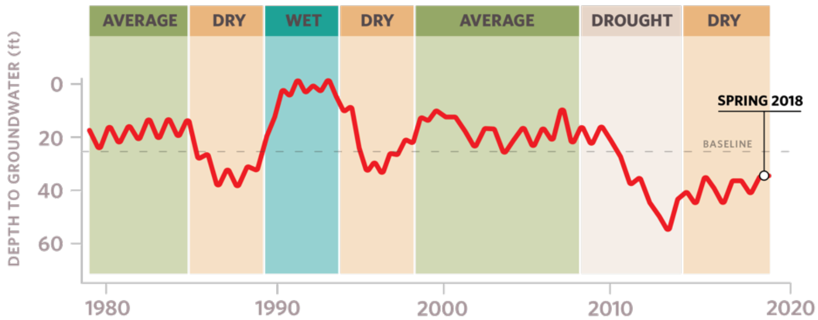

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

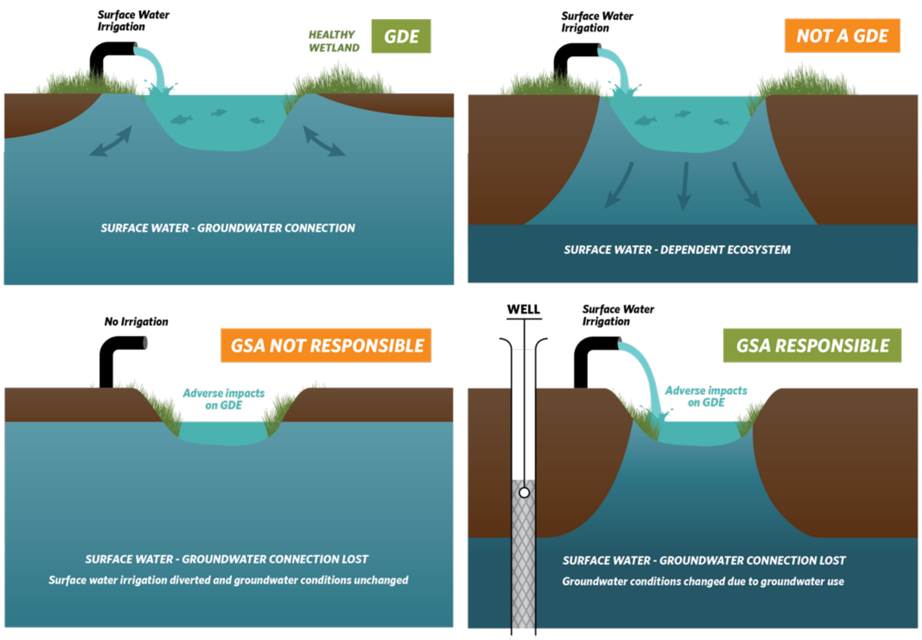

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

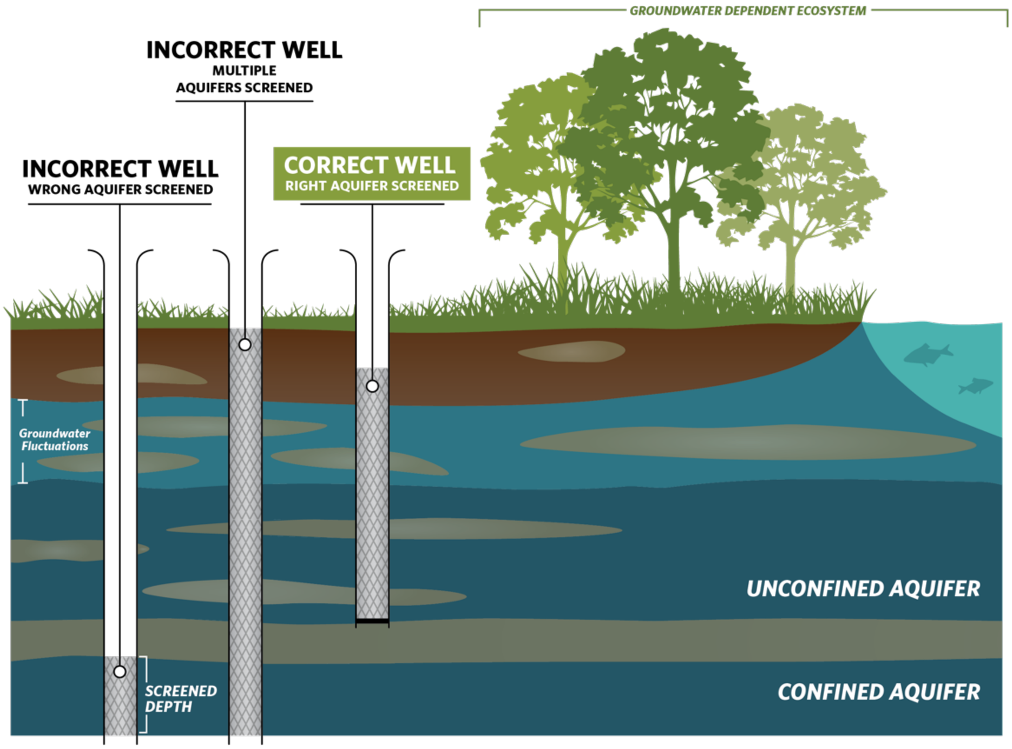

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

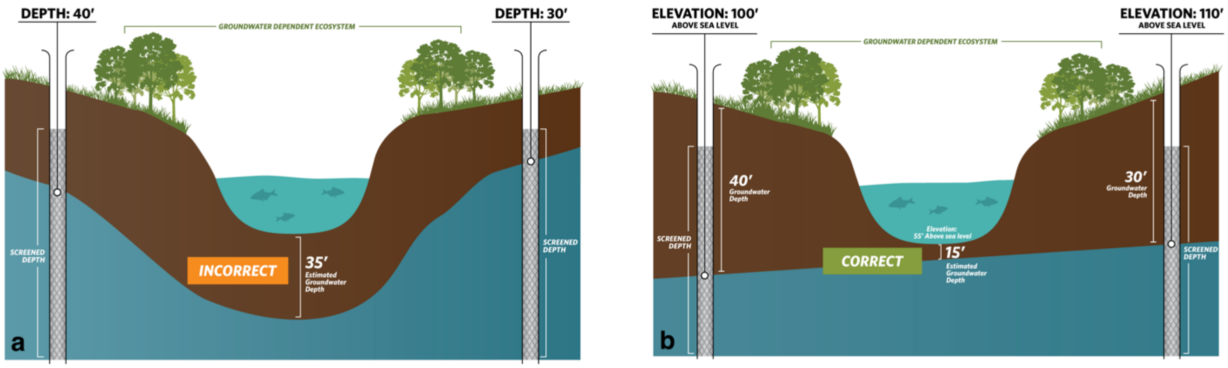

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

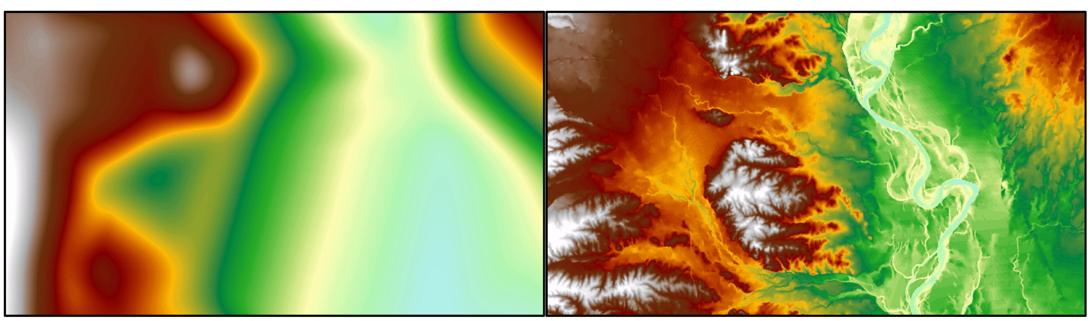

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

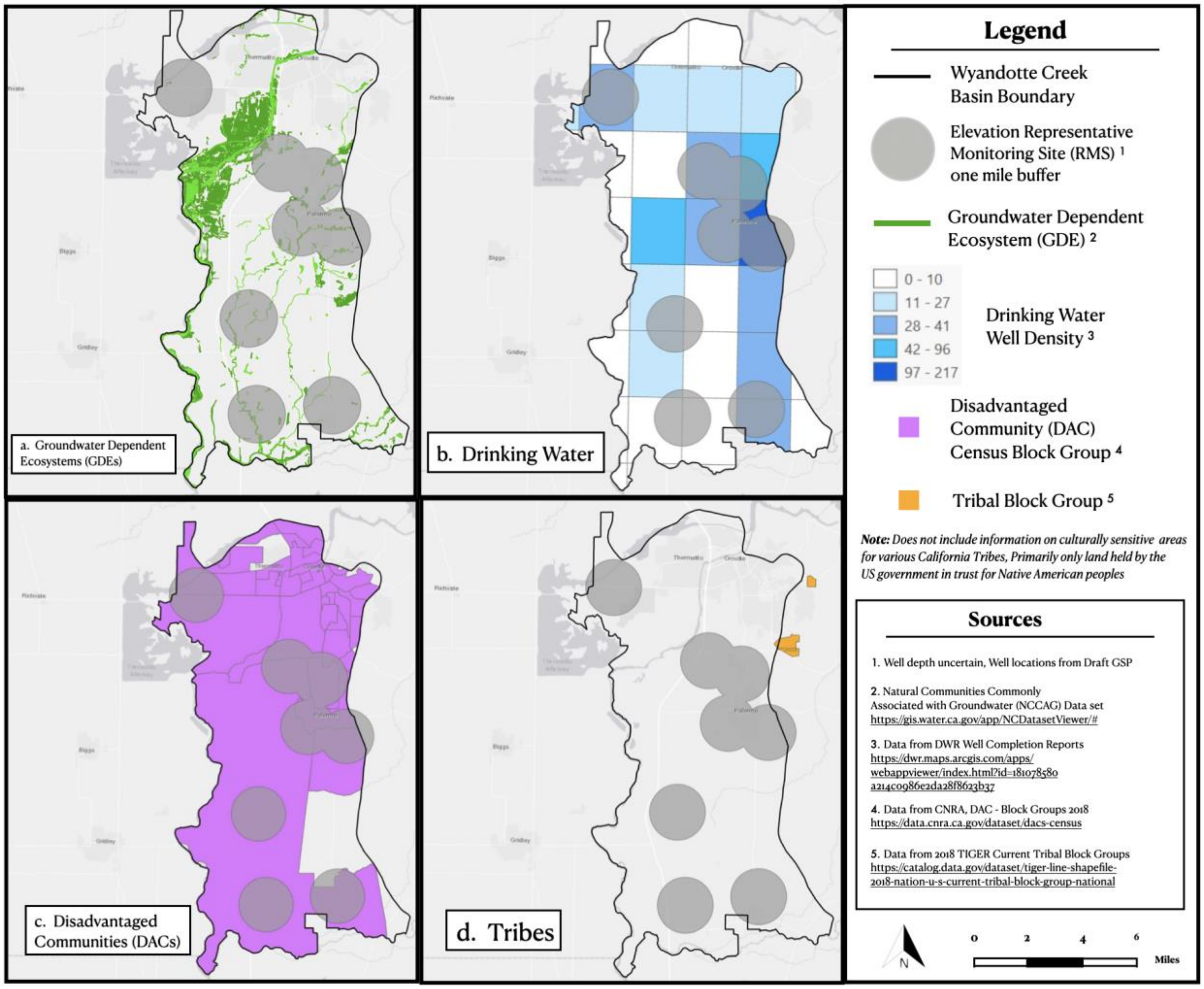

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

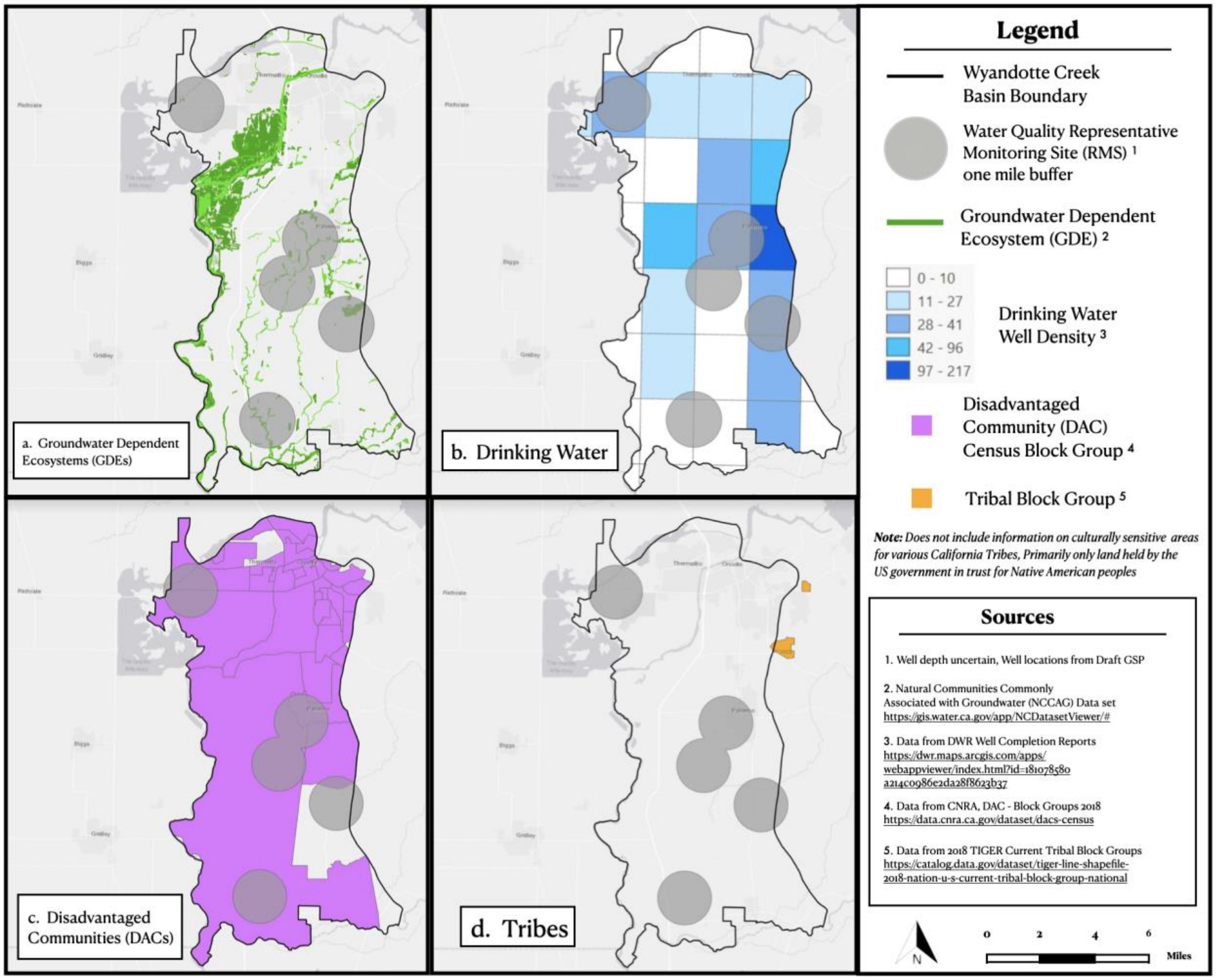

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

October 27, 2021

Yolo Subbasin Groundwater Agency (YSGA)
34274 State Highway 16
Woodland, CA 95695

Submitted via email: info@yolosga.org

Re: Public Comment Letter for Yolo Subbasin Draft GSP

Dear Kristin Sicke,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Yolo Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource-intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Yolo Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring points in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
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Melissa M. Rohde
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The Nature Conservancy

Amy Merrill, Ph.D.
Acting Director, California Program
American Rivers

Kristan Culbert
Associate Director, California Central Valley River Conservation
American Rivers

Attachment A

Specific Comments on the Yolo Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. We note the following deficiencies with the identification of these key beneficial users:

- The GSP fails to identify and map the locations of DACs, and describe the size of each DAC population within the subbasin.
- The GSP fails to identify and map tribal lands within the subbasin.
- The GSP provides a map of domestic well density in Figure 1.7, but fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the subbasin.
- The GSP fails to identify the population dependent on groundwater as their source of drinking water in the subbasin. Specifics are not provided on how much each DAC community relies on a particular water supply (e.g., what percentage is supplied by groundwater).

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Describe and map the locations of DACs and provide the size of each DAC population. The DWR DAC mapping tool can be used for this purpose.[2]

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

[2] The DWR DAC mapping tool is available online at: https://gis.water.ca.gov/app/dacs/.

- Provide a map of tribal lands and describe the tribal population within the subbasin.
- Include a map showing domestic well locations and average well depth across the subbasin.
- Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **incomplete**, based on incomplete identification of potential ISWs in the GSP.

We commend the YSGA for the thorough, comprehensive evaluation of ISWs in the subbasin. The methodology for the ISW analysis was adapted from The Nature Conservancy's ICONs map. The minimum groundwater elevation from water years 2006-2015 was intersected with the stream surface elevations. Gaining, losing, uncertain, and disconnected reaches are presented on Figure 2-47 (Interconnected Surface Water Bodies Under the Maximum Groundwater Elevation 2006-2015). The quantity and timing of depletions of interconnected surface waters is estimated by the Yolo Subbasin Groundwater Agency (YSGA) Model. The GSP presents the average annual stream seepage values and seasonal variability (spring and fall) of stream gains and losses as estimated by the model. Data gaps are identified and discussed in the text. The following recommendation would strengthen the clarity and completeness of the ISW evaluation.

RECOMMENDATION

- Clarify in the GSP text that reaches marked as 'uncertain' on Figure 2-47 are retained as *potential* ISWs in the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to the lack of a complete inventory, map, or description of fauna (e.g., birds, fish, amphibians) and flora (e.g., plants) species or habitat types in the subbasin's GDEs. Table 2-20 presents the number of species present in the subbasin's GDEs, but an inventory of those species is not provided.

Despite failing to identify fauna and flora, we commend the YSGA for their comprehensive evaluation of GDEs in the subbasin. The GSP mapped GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) (also referred to as the iGDE database in the GSP). The GSP presents a detailed discussion of the manner in which depth to groundwater, rooting depths, NDVI, and aerial imagery were used to establish GDE connection to groundwater. TNC's GDE Pulse tool was used to assess GDE vegetative health in the subbasin.

We commend the YSGA for their analysis of rooting depths of GDEs. The GSP states that where the depth to water was greater than 30 feet, GDEs were further evaluated based on an evaluation of the rooting depth of the dominant species within that polygon. The GSP states (2-114): "*Valley Oaks (Quercus lobata), for example, have a maximum rooting depth of nearly 25 feet. Studies suggest that the Valley Oak may be able to access groundwater much deeper, and up to nearly 80 feet in fractured rock ecosystems (Burgy, 1964).*" The GSP explains that the rooting depth is doubled as a conservative measure (in the case of valley oak, the 25 foot rooting depth is doubled to 50 feet for the screening threshold). We recommend instead that a 75-foot threshold be used for Valley Oak, supported by recent research which confirms Burgy (1964) and shows further that Valley Oak polygons from the NC dataset exhibit the ability to extend deep in alluvial systems to reach groundwater (up to approximately 75 feet).[3]

RECOMMENDATIONS
• Include an inventory of the fauna and flora present within the subbasin's GDEs (see Attachment C of this letter for a list of freshwater species located in the Yolo subbasin). Note any threatened or endangered species. • We recommend a depth-to-groundwater threshold of 75 feet be used instead of the 50 feet threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included into the water budget.[4,5] The integration of these ecosystems into the water budget is **insufficient**.

The water budget includes a separate item for evapotranspiration, but combines agriculture and native evapotranspiration into one term. The water budget did not explicitly include the current, historical, and projected demands of managed wetlands. The GSP states (4-29): "The YSGA water budget currently contains a data gap surrounding the consideration of managed wetlands. To ensure accurate consideration of managed wetlands moving forward, additional analysis and coordination will occur." We appreciate that managed wetlands are identified as a data gap in the budget, rather than left unrecognized. Please include a more detailed description of the process and timeline to address this data gap.

The omission of explicit water demands for native vegetation and managed wetlands is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

RECOMMENDATIONS
• Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including managed wetlands. If this is identified as a current data gap, then include a description of how it will be addressed, including a timeline for completion. • In the historical, current, and projected water budgets, include an individual line item for native vegetation, instead of lumping it together with agricultural evapotranspiration.

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[3] Groundwater dependence of riparian woodlands and the disrupting effect of anthropogenically altered streamflow

[4] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[5] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Notice and Communication Section (Section 1.5.5) of the Plan.[6]

We note the following deficiencies with the overall stakeholder engagement process:

- The GSP does not provide a stand-alone Stakeholder Communication and Engagement Plan for the subbasin.

- The opportunities for public involvement and engagement during the GSP development phase are not provided in the GSP. Groundwater users are mentioned in Section 1.5.5 as being stakeholders for public outreach activities in the subbasin, however no detailed information is provided on the type of outreach and engagement activities that have been conducted specifically for DACs, domestic well owners, tribes, and environmental stakeholders.

- The plan does not include a plan for continual opportunities for engagement through the implementation phase of the GSP for DACs, domestic well owners, tribes, and environmental stakeholders.

RECOMMENDATIONS

- Include a stand-alone, detailed and robust Stakeholder Communication and Engagement Plan that describes active and targeted outreach to engage DACs, domestic well owners, environmental stakeholders, and tribal stakeholders during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

- Describe efforts to consult and engage with DACs and domestic well owners within the subbasin.

- Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the subbasin within the GSP.[7]

- Describe efforts to consult and engage with environmental stakeholders within the subbasin.

[6] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]
[7] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[8,9,10]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP mentions impacts on drinking water users when defining undesirable results. The GSP does not, however, analyze direct and indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, or evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

The GSP identifies constituents of concern (COCs) in the subbasin as arsenic, hexavalent chromium, nitrate, chloride, sodium, boron, selenium, conductivity, and total dissolved solids (TDS). The GSP states (3-15): "*The YSGA has not established specific sustainable management criteria for water quality in the Subbasin but will rely on current and future water quality standards established for drinking water and agricultural water uses by State and county regulatory agencies."* However, SMC should be established for constituents in the subbasin that may be impacted or exacerbated by groundwater use and/or management, in addition to coordinating with water quality regulatory programs.

The GSP only includes a very general discussion of impacts on drinking water users when defining undesirable results and evaluating the cumulative or indirect impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss direct and indirect impacts on DACs, drinking water users, or tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

RECOMMENDATIONS
Chronic Lowering of Groundwater Levels ● Describe direct and indirect impacts on DACs, drinking water users, and tribes when describing undesirable results for chronic lowering of groundwater levels. ● Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs, drinking water users, and tribes within the subbasin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.

[8] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
[9] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[10] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Degraded Water Quality

- Establish SMC for the identified COCs in the subbasin that may be impacted or exacerbated by groundwater use and/or management. Ensure they align with drinking water standards.[11] Also, evaluate the cumulative or indirect impacts of proposed criteria for degraded water quality on DACs, drinking water users, and tribes.

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[12]

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts to GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing SMC for chronic lowering of groundwater levels.

Sustainable management criteria for depletion of interconnected surface water are established by proxy using groundwater levels at shallow near-stream representative monitoring wells. However, no analysis or discussion is presented to describe how the SMC will affect GDEs, or the impact of these minimum thresholds on GDEs in the subbasin. Furthermore, the GSP makes no attempt to evaluate the impacts of the proposed minimum threshold on environmental beneficial users of surface water. The GSP does not explain how the chosen minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin, such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the

[11] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]
[12] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

subbasin. Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[13,14]

- When establishing SMC for the basin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems".

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[15] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[6,16]

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[17] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources more critical for their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[18] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **incomplete**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2030 and 2070 and considers multiple climate scenarios (e.g., the 2070 dry-extreme weather and 2070 wetter-moderate warming climate scenarios) in the projected water budget.

The GSP incorporates climate change into key inputs (e.g., precipitation and evapotranspiration) of the projected water budget. However, climate change was not incorporated into surface water flow inputs. Furthermore, the GSP does not calculate a sustainable yield based on the projected water budget with

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[13] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[14] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[15] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]
[16] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf
[17] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]
[18] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

climate change incorporated. If the water budgets are incomplete, including the omission of projected climate change effects on surface water flow inputs, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, tribes, and domestic well owners.

RECOMMENDATIONS
• Incorporate climate change into surface water flow inputs for the projected water budget. • Calculate sustainable yield based on the projected water budget with climate change incorporated. • Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Wells (RMWs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, tribes, GDEs, and ISWs in the subbasin.

The GSP states (p. 4-11): "Rather than developing a new monitoring program, the YSGA will rely on existing programs to monitor water quality in the Subbasin." However, specific well names or locations are not provided for this monitoring network.

Figure 4-1 (Yolo Subbasin Groundwater Elevation Representative Monitoring Wells) shows that no groundwater elevation monitoring wells are located across portions of the subbasin near DACs, domestic wells, and tribes (see maps provided in Attachment E). Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[19]

The GSP provides some discussion of data gaps for GDEs and ISWs in Sections 4.8.5 (Data Gaps) and Section 4.11.2.3 (Surface Water, Interconnected Surface Water, and Groundwater Dependent Ecosystem Monitoring Network), however does not provide specific plans, such as locations or a timeline, to fill the data gaps.

RECOMMENDATIONS
• Establish a monitoring network for the groundwater quality condition indicator. • Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, tribes, GDEs, and ISWs to clearly identify potentially impacted areas. Increase the number of RMWs in the shallow aquifer across the subbasin as needed to adequately monitor all groundwater condition

[19] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

- indicators. Prioritize proximity to DACs, domestic wells, tribes, and GDEs when identifying new RMWs.

- Further describe the biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, drinking water users, and tribes. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program. The GSP includes a brief discussion of a domestic well Impact mitigation program in Table 5-1, but very few details are provided.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. The GSP mentions creation of seasonal wetlands in Table 5-1 under the 'Groundwater Recharge and Managed Aquifer Recharge Projects'. For further guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[20]

- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

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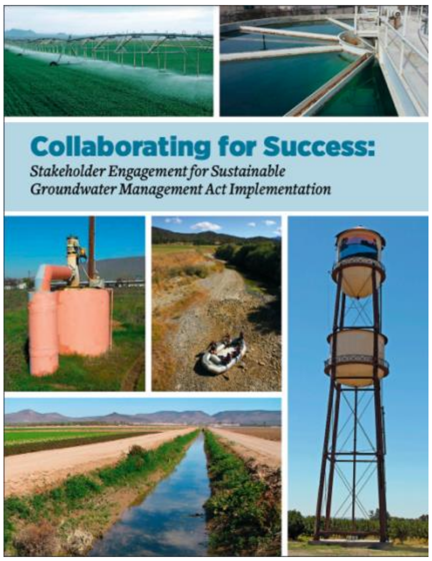
[20] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



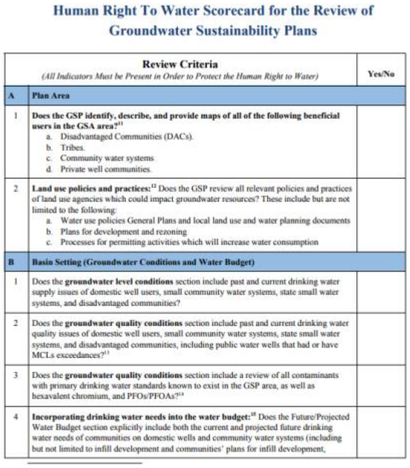
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

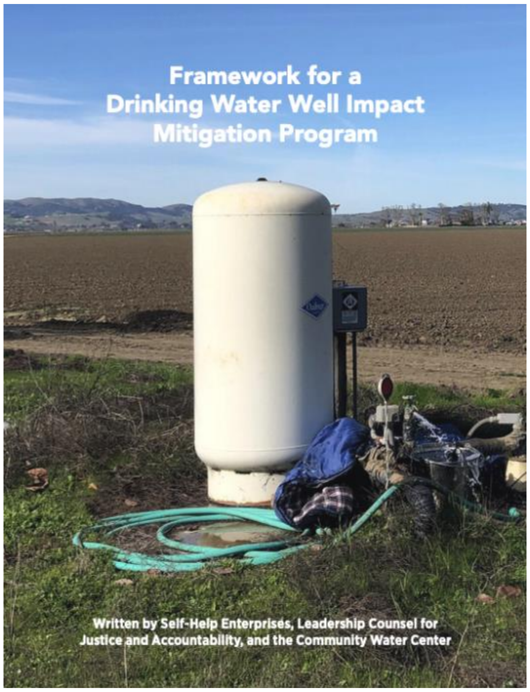


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria (All Indicators Must be Present in Order to Protect the Human Right to Water)	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

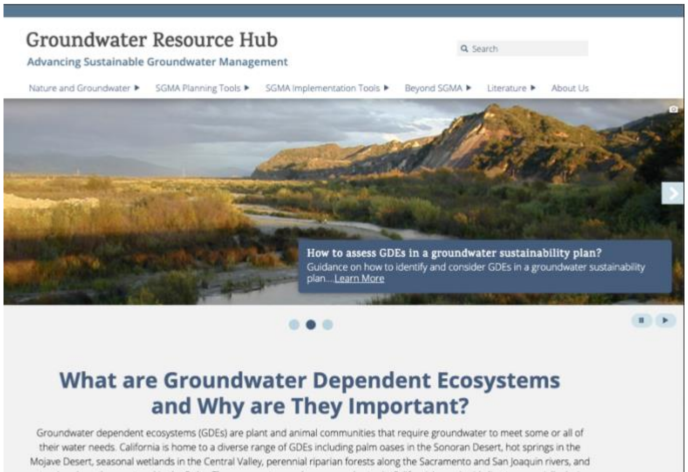
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



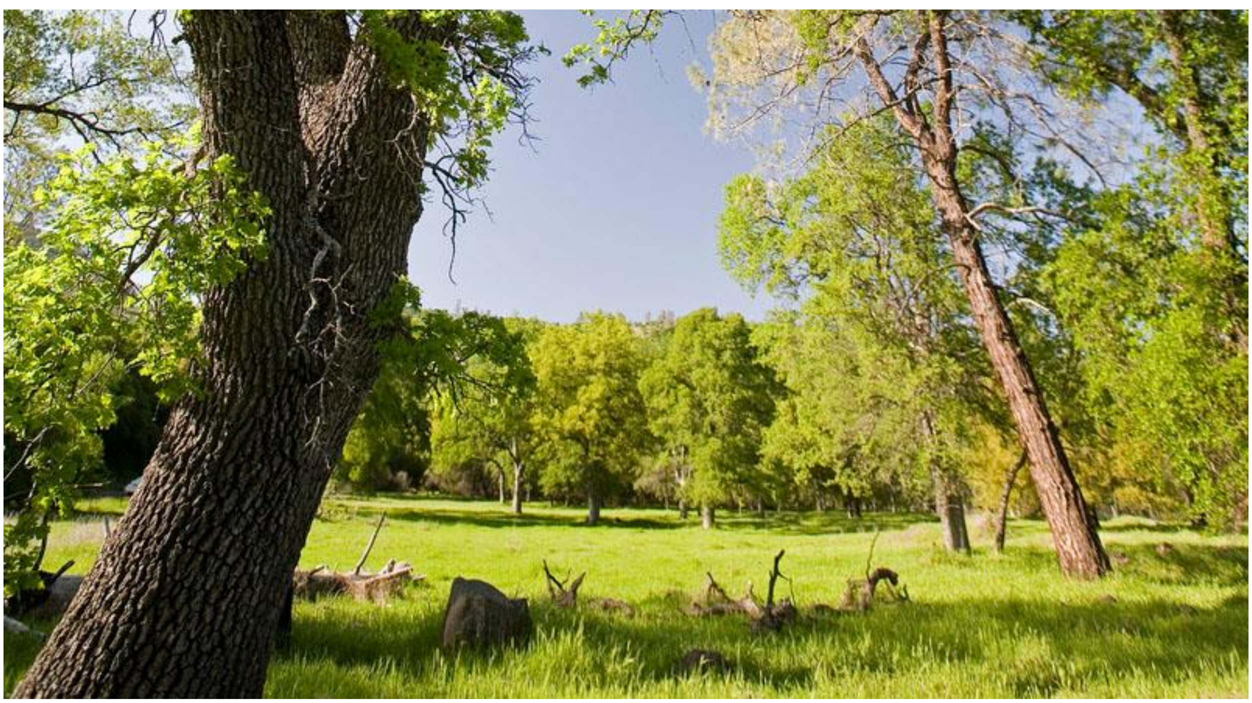
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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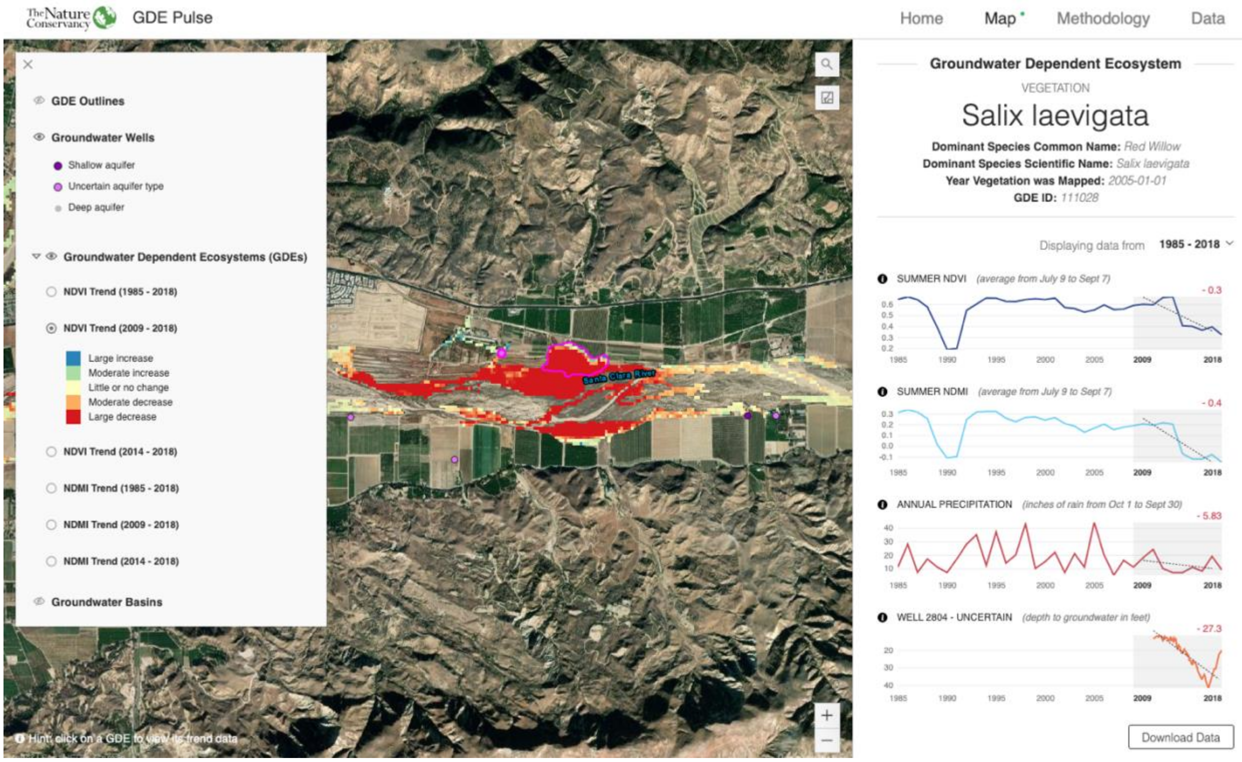
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

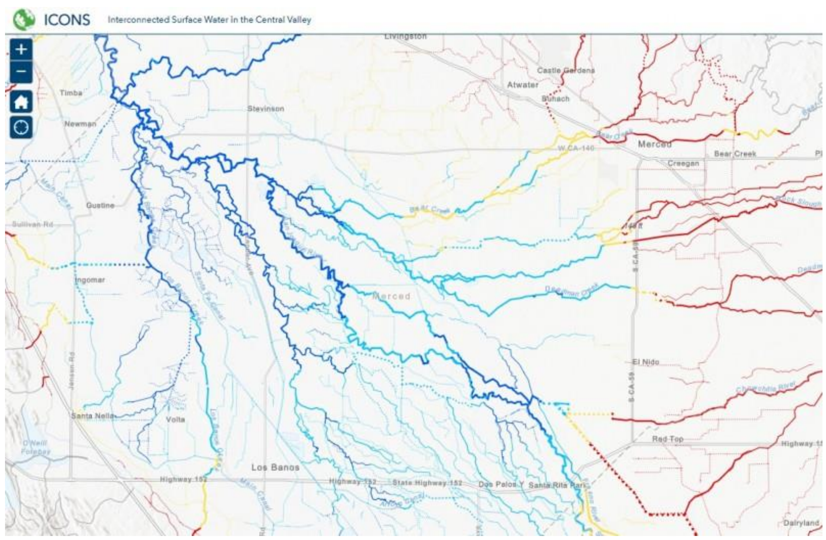
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Yolo Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Yolo Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	**State**	**Other**
BIRDS				
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Candidate - Threatened	Endangered	
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			

Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta conservatio	Conservancy Fairy Shrimp	Endangered	Special	IUCN - Endangered
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Branchinecta mesovallensis	Midvalley Fairy Shrimp		Special	
Hyalella spp.	Hyalella spp.			
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
Stygobromus spp.	Stygobromus spp.			
FISH				
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013

Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endangered	Endangered	Vulnerable - Moyle 2013
Pogonichthys macrolepidotus	Sacramento splittail		Special Concern	Vulnerable - Moyle 2013
Spirinchus thaleichthys	Longfin smelt	Candidate	Threatened	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus boreas halophilus	California Toad			ARSSC
Dicamptodon ensatus	California Giant Salamander			ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis fitchi	Valley Gartersnake			Not on any status lists
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Ablabesmyia spp.	Ablabesmyia spp.			
Aeshna interrupta interna				
Aeshnidae fam.	Aeshnidae fam.			
Ambrysus spp.	Ambrysus spp.			
Ameletus imbellis	A Mayfly			
Anax junius	Common Green Darner			
Anax walsinghami	Giant Green Darner			

Archilestes californica	California Spreadwing			
Argia emma	Emma's Dancer			
Argia lugens	Sooty Dancer			
Argia vivida	Vivid Dancer			
Caenis spp.	Caenis spp.			
Callibaetis fluctuans	A Mayfly			
Callibaetis spp.	Callibaetis spp.			
Centroptilum spp.	Centroptilum spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Dubiraphia spp.	Dubiraphia spp.			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Erpetogomphus compositus	White-belted Ringtail			
Erythemis collocata	Western Pondhawk			
Fallceon quilleri	A Mayfly			
Glyptotendipes spp.	Glyptotendipes spp.			
Gomphus kurilis	Pacific Clubtail			
Gyrinus affinis				Not on any status lists
Helicopsyche spp.	Helicopsyche spp.			
Hetaerina americana	American Rubyspot			
Hydropsyche spp.	Hydropsyche spp.			
Ischnura cervula	Pacific Forktail			
Ischnura denticollis	Black-fronted Forktail			
Ischnura perparva	Western Forktail			
Labrundinia spp.	Labrundinia spp.			
Libellula forensis	Eight-spotted Skimmer			
Libellula luctuosa	Widow Skimmer			
Libellula pulchella	Twelve-spotted Skimmer			
Libellula saturata	Flame Skimmer			
Microchironomus spp.	Microchironomus spp.			
Microvelia spp.	Microvelia spp.			
Mideopsis spp.	Mideopsis spp.			
Nectopsyche spp.	Nectopsyche spp.			
Neoclypeodytes spp.	Neoclypeodytes spp.			

Ochthebius spp.	Ochthebius spp.			
Octogomphus specularis	Grappletail			
Oecetis spp.	Oecetis spp.			
Pachydiplax longipennis	Blue Dasher			
Pantala flavescens	Wandering Glider			
Pantala hymenaea	Spot-winged Glider			
Paraleptophlebia cachea	A Mayfly			
Paratanytarsus spp.	Paratanytarsus spp.			
Pentaneura spp.	Pentaneura spp.			
Plathemis lydia	Common Whitetail			
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Progomphus borealis	Gray Sanddragon			
Rhagovelia distincta				Not on any status lists
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhionaeschna multicolor	Blue-eyed Darner			
Sperchon spp.	Sperchon spp.			
Sympetrum corruptum	Variegated Meadowhawk			
Tanytarsus spp.	Tanytarsus spp.			
Tramea lacerata	Black Saddlebags			
Tricorythodes spp.	Tricorythodes spp.			
Zoniagrion exclamationis	Exclamation Damsel			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Ferrissia spp.	Ferrissia spp.			
Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus spp.	Gyraulus spp.			
Margaritifera falcata	Western Pearlshell		Special	
Physa spp.	Physa spp.			
PLANTS				
Alnus rhombifolia	White Alder			
Alopecurus carolinianus	Tufted Foxtail			
Alopecurus saccatus	Pacific Foxtail			

Arundo donax	NA			
Baccharis salicina				Not on any status lists
Bolboschoenus fluviatilis				Not on any status lists
Bolboschoenus glaucus	NA			Not on any status lists
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Carex nudata	Torrent Sedge			
Cephalanthus occidentalis	Common Buttonbush			
Chloropyron palmatum	NA	Endangered	Special	CRPR - 1B.1
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Crypsis vaginiflora	NA			
Cyperus erythrorhizos	Red-root Flatsedge			
Damasonium californicum				Not on any status lists
Downingia insignis	Parti-color Downingia			
Downingia ornatissima	NA			
Downingia pulchella	Flat-face Downingia			
Elatine californica	California Waterwort			
Elatine rubella	Southwestern Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Elodea canadensis	Broad Waterweed			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium aristulatum aristulatum	California Eryngo			
Eryngium castrense	Great Valley Eryngo			
Eryngium jepsonii	NA			Not on any status lists
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Helenium puberulum	Rosilla			
Hibiscus lasiocarpos occidentalis			Special	CRPR - 1B.2
Juncus uncialis	Inch-high Rush			

Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lemna minor	Lesser Duckweed			
Lemna minuta	Least Duckweed			
Lilaeopsis masonii	Mason's Lilaeopsis		Special	CRPR - 1B.1
Limnanthes douglasii rosea	Douglas' Meadowfoam			
Limosella acaulis	Southern Mudwort			
Ludwigia hexapetala	NA			Not on any status lists
Ludwigia peploides montevidensis	NA			Not on any status lists
Ludwigia peploides peploides	NA			Not on any status lists
Lythrum californicum	California Loosestrife			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus latidens	Broad-tooth Monkeyflower			
Mimulus pilosus				Not on any status lists
Mimulus tricolor	Tricolor Monkeyflower			
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Myriophyllum aquaticum	NA			
Navarretia cotulifolia	Cotula Navarretia			
Navarretia heterandra	Tehama Navarretia			
Navarretia leucocephala bakeri	Baker's Navarretia		Special	CRPR - 1B.1
Navarretia leucocephala leucocephala	White-flower Navarretia			
Neostapfia colusana	Colusa Grass	Threatened	Endangered	CRPR - 1B.1
Paspalum distichum	Joint Paspalum			
Perideridia kelloggii	Kellogg's Yampah			
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Pleuropogon californicus californicus				Not on any status lists

Pogogyne douglasii	NA			
Pogogyne zizyphoroides				Not on any status lists
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Psilocarphus tenellus	NA			
Puccinellia simplex	Little Alkali Grass			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rumex conglomeratus	NA			
Rumex stenophyllus	NA			
Rumex transitorius				Not on any status lists
Salix babylonica	NA			
Salix exigua exigua	Narrowleaf Willow			
Salix exigua hindsiana				Not on any status lists
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Salix melanopsis	Dusky Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus americanus	Three-square Bulrush			
Schoenoplectus pungens longispicatus	Three-square Bulrush			
Schoenoplectus pungens pungens	NA			
Scirpus microcarpus	Small-fruit Bulrush			
Sinapis alba	NA			
Stachys ajugoides	Bugle Hedge-nettle			
Stachys stricta	Sonoma Hedge-nettle			
Symphyotrichum lentum	Suisun Marsh Aster		Special	CRPR - 1B.2
Tuctoria mucronata	Mucronate Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Veronica anagallis-aquatica	NA			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

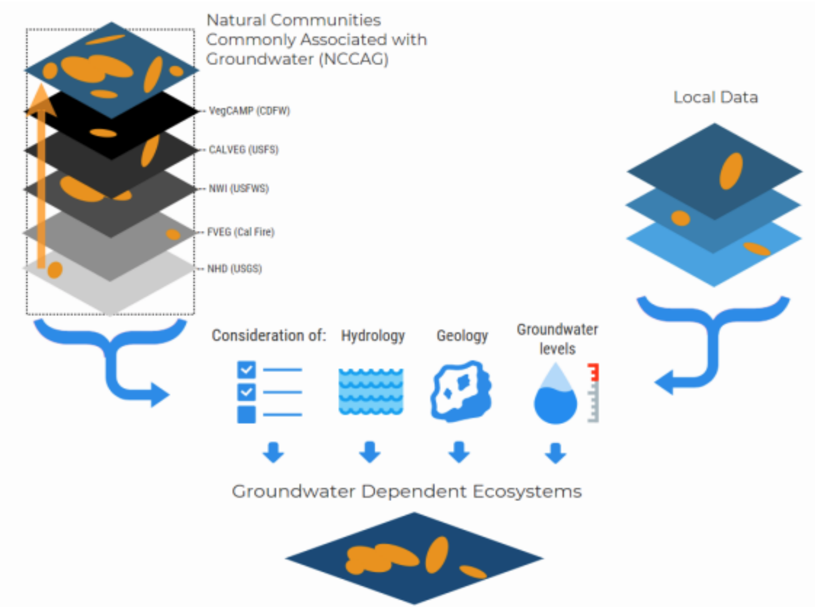


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

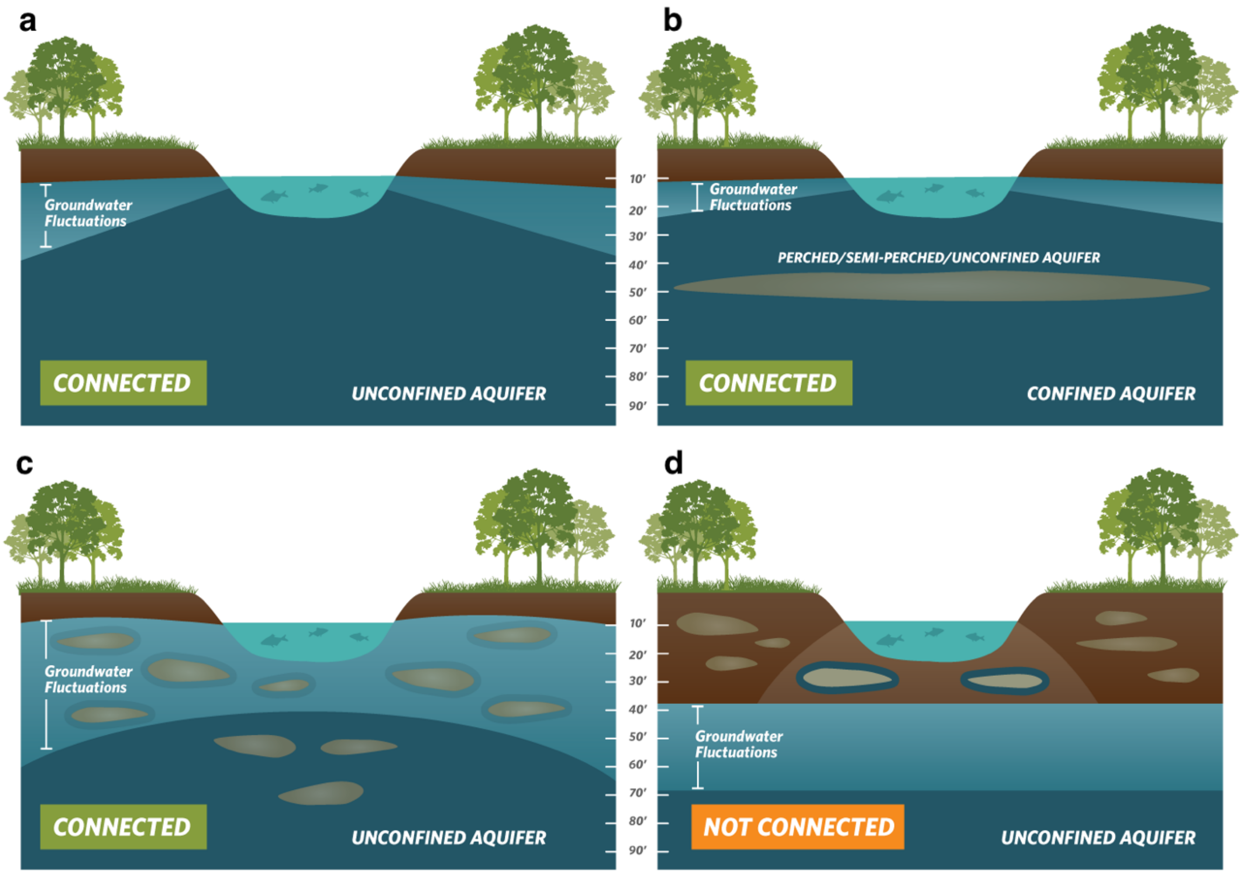

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

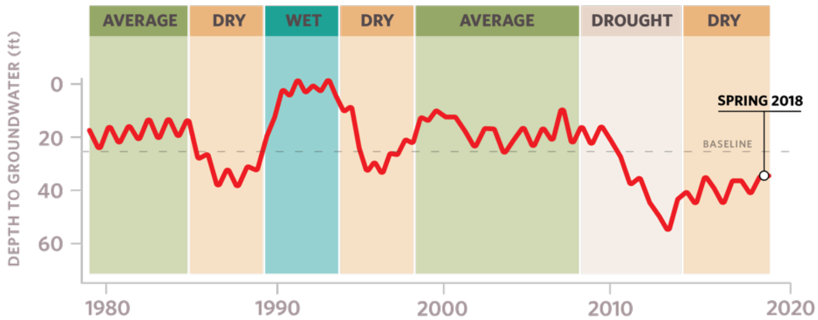

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

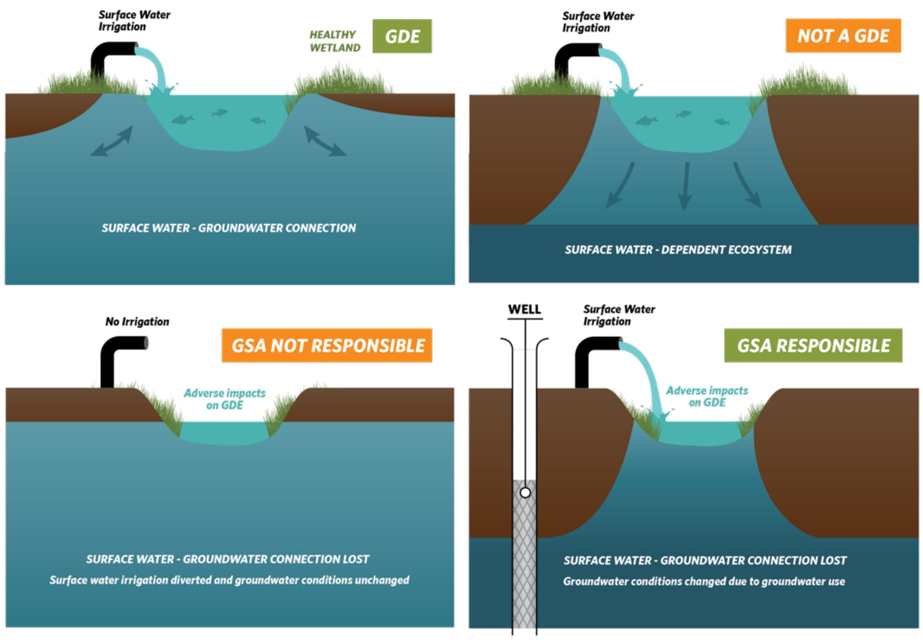

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

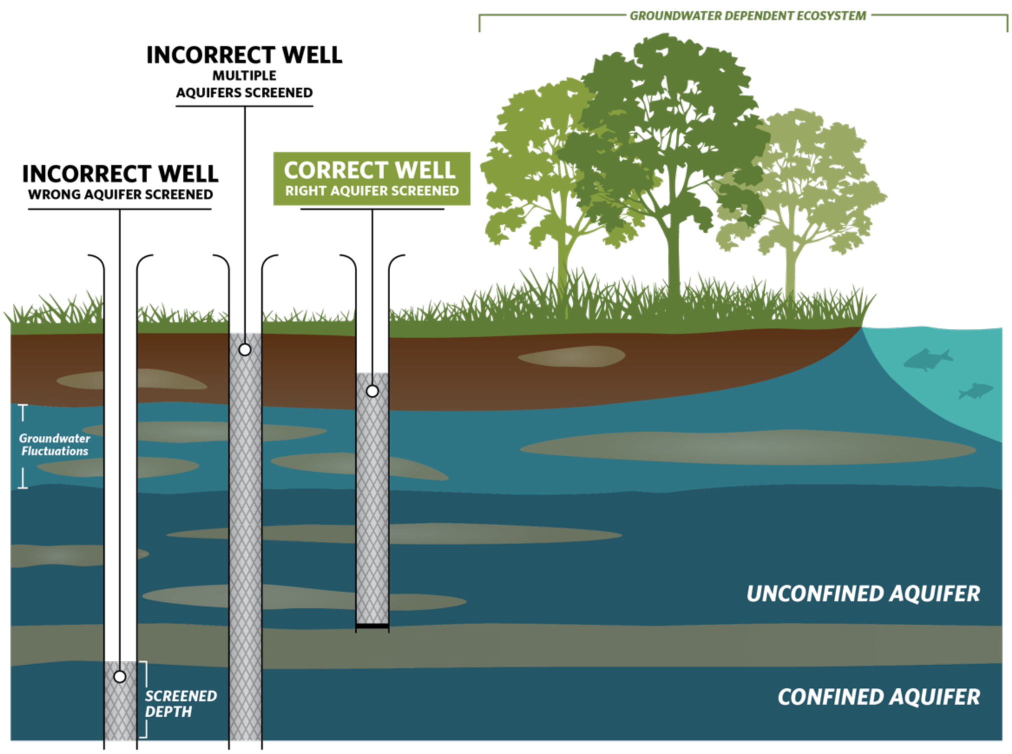

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

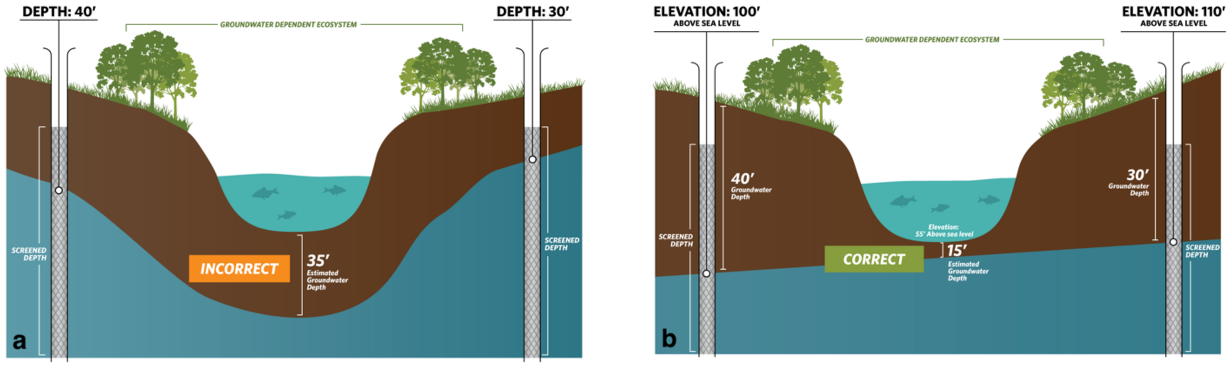

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

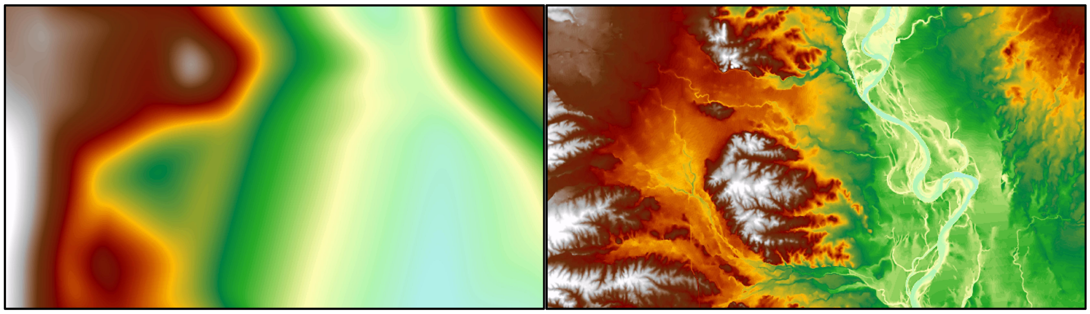

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

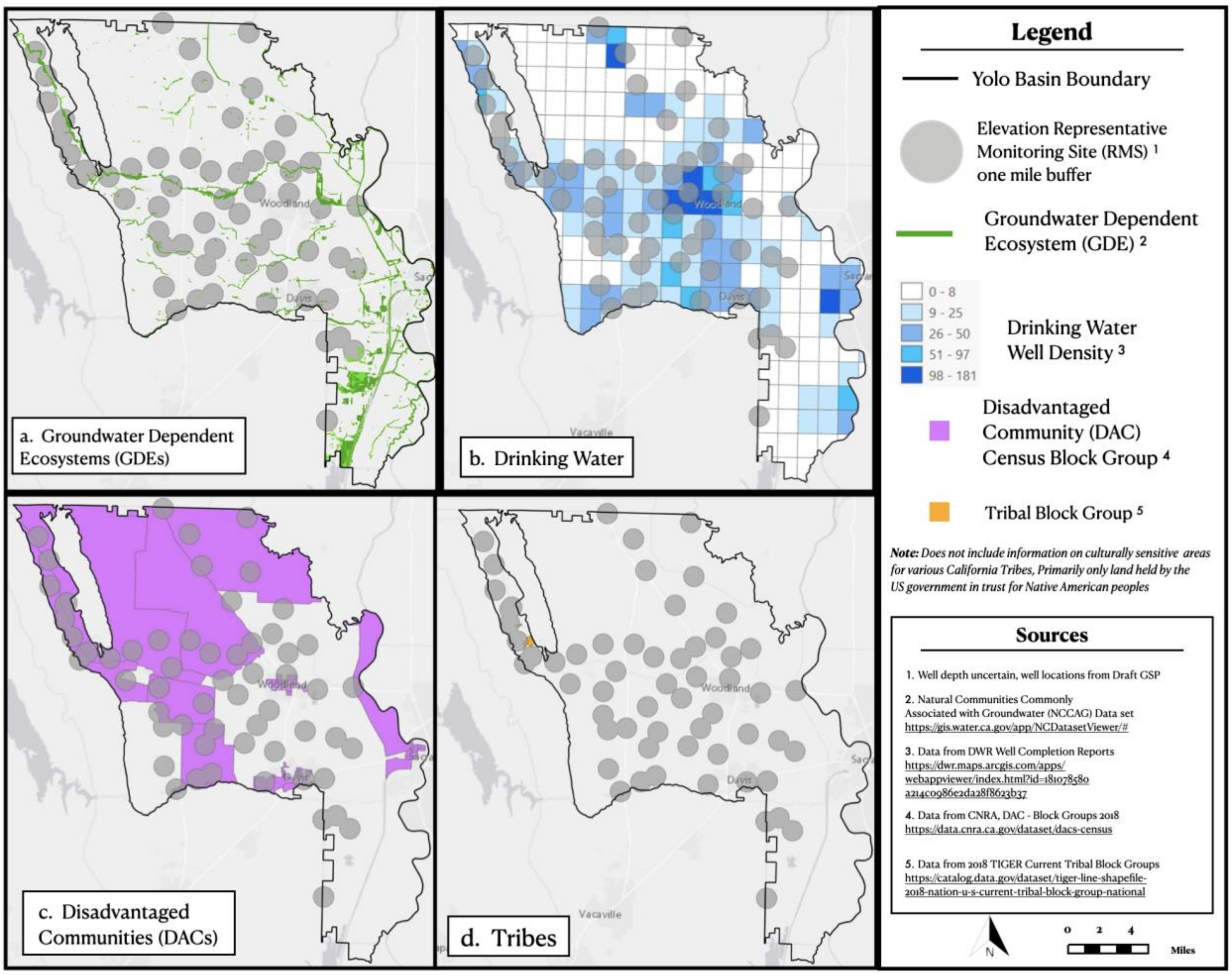

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

December 3, 2021

Yucaipa Groundwater Sustainability Agency
℅ San Bernardino Valley Municipal Water District
San Bernardino, California, 92408

Submitted via email: yucaipasgma@gmail.com

Re: Public Comment Letter for Yucaipa Subbasin Draft GSP

Dear Mark Iverson,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Yucaipa Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Yucaipa Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"
Attachment E	Maps of representative monitoring sites in relation to key beneficial users

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Yucaipa Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**. The GSP provides information on DACs, including identification by name and location on a map (Appendix 1-C, Figure 3). However, the GSP fails to clearly state the population of each DAC or provide the population of DACs dependent on groundwater as their source of drinking water in the subbasin.

The plan fails to provide a density map or depth of domestic wells (such as minimum well depth, average well depth, or depth range) within the subbasin. This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the subbasin.

These missing elements are required for the GSAs to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS
• Provide the population of each identified DAC. Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). • Include a domestic well density map and a map showing domestic well locations and average well depth across the subbasin.

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP describes the use of a

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

groundwater model, the Yucaipa Integrated Hydrologic Model (YIHM), to analyze the interaction between groundwater and surface water within the subbasin. The model is briefly described in the Water Budget section of the GSP. The GSP provides a placeholder for the model documentation in Appendix 2-D, but this appendix was not provided as part of the draft GSP.

The GSP provides general statements regarding the connected nature of certain reaches in the Water Budget section of the GSP. The GSP states (p. 2-68): *"Groundwater in the Yucaipa Subbasin discharges to Oak Glen Creek, Wilson Creek, Yucaipa Creek, and San Timoteo Creek when underlying groundwater elevations are above the bottom elevation of each stream channel. Groundwater conditions that cause this are influenced by local pumping, climatic conditions, upstream stream leakage, and subsurface inflows from adjacent Subbasins, crystalline bedrock, and the San Timoteo Badlands."* However, the GSP does not provide a map of these reaches to illustrate the conclusions of the modeling analysis regarding which reaches are connected to groundwater.

RECOMMENDATIONS

- Provide a map showing all the stream reaches in the subbasin, with reaches clearly labeled as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.

- In the main text of the GSP, summarize the groundwater elevation data and stream flow data used in the modeling analysis. Discuss temporal (seasonal and interannual) variability of the data used to calibrate the model.

- To confirm and illustrate the results of the groundwater modeling, overlay the subbasin's stream reaches with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis.

- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, we found that some mapped features in the NC dataset were improperly disregarded.

- NC dataset polygons were incorrectly removed if Normalized Difference Vegetation Index (NDVI) and Normalized Difference Moisture Index (NDMI) data did not correlate with groundwater level trends. This is an incorrect method, since a lack of a relationship does not preclude that groundwater is providing some of the ecosystem's water needs. If the ecosystem is tapping into shallow groundwater then the ecosystem should be categorized as a GDE. If there are no data to characterize groundwater conditions in the shallow principal aquifer, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP.

- NC dataset polygons were incorrectly removed in areas where previous site investigations indicated that the habitats were sustained by surface water. However, this removal criteria is flawed since GDEs can rely on multiple water sources – including surface water *and* groundwater – simultaneously and at different temporal/spatial scales. NC dataset polygons adjacent to surface water supplies can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed solely based on their proximity to these additional water sources.

The text discusses groundwater level trends in each of the GDE units over the period 2009 to 2019, referring to specific well names. The wells are not labeled on the GDE map (Figure 2-57), however. The GSP could be improved by labeling the GDE units and labeling each well location provided on this figure, and providing the hydrographs of groundwater levels that are discussed qualitatively in the text.

The GSP presents the subbasin's common phreatophytes in Table 2-9 and describes the habitat types when discussing each GDE unit. However, the GSP does not provide a description or inventory of the subbasin's fauna or discuss endangered, threatened, or special status species.

RECOMMENDATIONS

- Re-evaluate the NC dataset polygons that were incorrectly removed based on NDVI and NDMI trends or proximity to surface water. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.
- Label the GDE units and label each well location provided on Figure 2-57. Provide the hydrographs of groundwater levels that are discussed qualitatively in the text.
- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.
- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.
- Provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin and note any threatened or endangered species (see Attachment C in this letter for a list of freshwater species located in the Yucaipa Subbasin).

Native Vegetation and Managed Wetlands
Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of native vegetation into the water budget is **insufficient**. The water budget did not include the current, historical, and projected demands of native vegetation. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the subbasin.

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.

- State whether or not there are managed wetlands in the subbasin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development
Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Public Outreach and Engagement Plan (Appendix 1-C).[4]

The GSP documents targeted outreach to DACs, including specific representation of DACs on the Yucaipa GSA by both the City representatives and water suppliers of the DACs within the subbasin. However, we note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement in very general terms. These include meeting opportunities through the SGMA Board's quarterly meetings, Technical Advisory Group meetings during GSP development, SGMA Board appointed membership, and communication and engagement through the GSP webpage.

- The plan lacks specific details of outreach and engagement targeted to environmental stakeholders. In Section 1.8.6, the GSP documents environmental users as the subbasin's GDEs. We recommend that the GSA engage with environmental stakeholders

[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]
[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]
[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

in the subbasin, which could include California Department of Fish and Wildlife or environmental non-profits.

- Section 1.7.1 of the GSP states that notification and communication will continue to take place during the implementation phase of the GSP. However, the GSP describes outreach during GSP implementation as limited to *“engagement with the public and beneficial users regarding the progress of monitoring and reporting updates on the GSP to DWR, establishment of fees, and the development and implementation of management strategies, including projects as needed.”* The discussion of public notice and engagement does not include a detailed plan for continual opportunities for engagement through the implementation phase of the GSP that is specifically directed to DACs, domestic well owners, and environmental stakeholders within the subbasin.

RECOMMENDATIONS

- In the Public Outreach and Engagement Plan, describe active and targeted outreach to engage all stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.
- Engage with environmental stakeholders in the subbasin, which could include California Department of Fish and Wildlife or environmental non-profits.
- Provide documentation on how stakeholder input was incorporated into the GSP development process.
- Utilize DWR’s tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the subbasin.[5]

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

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[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] “The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.” [23 CCR §354.26(b)(3)]

[7] “The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.” [23 CCR §354.28(b)(4)]

[8] “The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference.” [23 CCR §354.28(b)(5)]

Disadvantaged Communities and Drinking Water Users
To establish minimum thresholds for each of four management areas, the GSP identifies the historic low storage volume, assigns a drought buffer to further lower the storage volume, and then uses the YIHM to determine the corresponding groundwater elevations at representative monitoring points (RMPs). The GSP does not quantify the number of domestic wells that could go dry or otherwise consider or analyze the impact of minimum thresholds on domestic wells. The GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs or drinking water users when defining undesirable results, nor does it describe how the groundwater levels minimum thresholds are consistent with the Human Right to Water policy.[9]

The GSP does not establish SMC for groundwater quality. The GSP states (p. 3-2): *"Degradation of groundwater quality does not apply to the Plan Area as agriculture use has declined markedly since the 1950s to approximately 7% of the total land use, and the concerted efforts by the Yucaipa GSA member agencies to convert from septic systems to sanitary sewer systems has decreased nitrate and salt contributions to the aquifer. Limited contamination at some active remediation sites and the cessation of operations at the former Yucaipa Landfill have limited contamination to shallow, perched groundwater that has not impacted water quality in the principal aquifer."* Section 2.7.4 (Groundwater Quality) discusses other COCs, both naturally occurring and those associated with industrial activities, that have exceeded regulatory standards. All COCs in the subbasin that may be impacted or exacerbated by groundwater use and/or management should have established SMC, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users and DACs when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels. Include information on the impacts during prolonged periods of below average water years.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users and DACs within the subbasin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be fully or partially de-watered at the minimum threshold.

Degraded Water Quality

- Establish water quality SMC. Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management.

- Describe direct and indirect impacts on drinking water users and DACs when defining undesirable results for degraded water quality.[10] For specific guidance on how to

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3
[10] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[11]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users and DACs.

Groundwater Dependent Ecosystems and Interconnected Surface Waters
We commend the GSA for evaluating potential cause and effect relationships between groundwater and remote sensing (NDVI, NDMI) data when establishing sustainable management criteria for the ISW sustainability indicator. However, sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the subbasin, they must be considered when developing all relevant SMC.

For depletion of interconnected surface waters, the GSP establishes the undesirable result but does not determine minimum thresholds. The undesirable result is established as follows (p. 3-6): *"A significant and unreasonable loss of GDE habitat may occur if there is a long-term decline in groundwater levels below 30 feet bgs."* The GSP continues (p. 3-6): *"Because the potential GDEs are not located near existing or currently planned groundwater extraction wells, it is not anticipated that they will be impacted by future extractions within the Plan Area. However, in the event that future groundwater production is planned within a mile of a potential GDE, additional investigations should be performed to identify whether the potential GDE relies on groundwater, and whether the planned production may negatively impact the potential GDE. If the potential GDE is found to rely on groundwater and planned production may impact groundwater levels in the vicinity of the potential GDE, sustainability criteria related to the depletion of interconnected surface water may be established to protect against the significant and unreasonable loss of GDE habitat."* Because ISWs have been identified in the subbasin, the GSA needs to define what significant and unreasonable effects are for ISWs, and the GSA should not wait for future well development to establish SMC. Also, please note that significant and unreasonable losses of GDE habitat can occur when groundwater levels decline within 30 feet bgs, as observed in Fillmore and Piru groundwater basins[12].

While the GSP identifies terrestrial GDEs, it does not identify or mention surface water beneficial users in the subbasin. In establishing SMC for depletion of interconnected surface water, the GSP should evaluate how the proposed minimum thresholds and measurable objectives avoid significant and unreasonable effects on surface water beneficial users in the subbasin (see Attachment C for a list of environmental users in the subbasin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

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[11] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.
[12] Kibler CL, Schmidt EC, Roberts DA, Stella JC, Kui L, Lambert AM, Singer MB. A brown wave of riparian woodland mortality following groundwater declines during the 2012-2019 California drought. Environmental Research Letters 16(8): 084030. https://doi.org/10.1088/1748-9326/ac1377

RECOMMENDATIONS

- When establishing SMC for the subbasin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."
- Evaluate impacts on GDEs when establishing SMC for chronic lowering of groundwater levels. When defining undesirable results, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin.[13] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[14]
- Establish SMC for depletion of interconnected surface water. When defining undesirable results, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.[15] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[8,16]

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[17] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more

[13] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[14] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[15] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[16] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[17] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

on groundwater during times of drought.[18] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the subbasin. While these extreme scenarios may have a lower likelihood of occurring and their consideration is not required by DWR (only suggested), their consequences could be significant and their inclusion can help identify important vulnerabilities in the subbasin's approach to groundwater management.

The GSP integrates climate change into key inputs (e.g., changes in precipitation and evapotranspiration) of the projected water budget. However, the GSP does not adjust imported surface water supplies based on future climate change scenarios. Additionally, the sustainable yield is not calculated based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extreme climate scenarios, projected climate change effects on imported water inputs, and climate change projections in the sustainable yield calculations, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Integrate climate change into imported water inputs for the projected water budget.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around domestic wells, GDEs, and ISWs in the subbasin. These beneficial users may remain unprotected by the GSP without adequate

[18] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[19]

Figure 3-5 (Representative Monitoring Points) shows insufficient representation of GDEs and drinking water users for groundwater elevation monitoring and water quality monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater.

The GSP provides discussion of data gaps for GDEs throughout the Sustainable Management Section of the GSP. For example, the GSP states (p. 3-26): *"If future extractions planned in this region are expected to exceed historical extractions in the region, additional field work may be required to characterize the impact that proposed pumping rates will have on the potential GDE in the Singleton subarea. This would include installing one or more shallow groundwater observation wells screened from the historical high groundwater level to approximately 35 feet bgs. Groundwater elevation data collected from the shallow groundwater observation well(s) will be analyzed to evaluate whether the local habitat is sustained by shallow groundwater (<30 feet bgs), and will be used to evaluate seasonal fluctuations and potential influences by nearby pumping in the principal aquifer."* The GSP does not provide specific plans, such as locations or a timeline, to fill the data gaps for GDEs. Because GDEs have been identified in the subbasin, these data gaps should be addressed now instead of waiting for groundwater extraction to increase in the future.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify monitored areas.
- Increase the number of RMPs in the shallow aquifer across the subbasin as needed to map ISWs and adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMPs.
- Ensure groundwater elevation and water quality RMPs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, and GDEs.
- Further describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management

[19] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

The GSP fails to describe the explicit benefits or impacts to beneficial users, such as GDEs and DACs, from Management Action No. 3, Surplus Supplemental Water Spreading. We also note that the plan does not include a domestic well mitigation program to avoid significant and unreasonable loss of drinking water. We strongly recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[20]

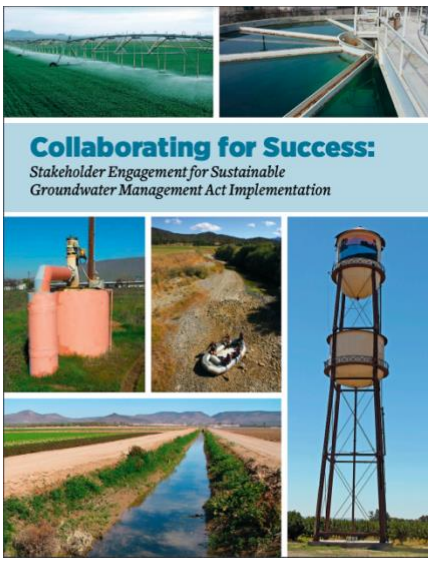
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[20] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

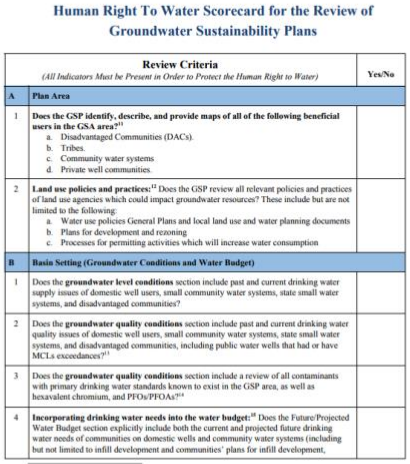
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

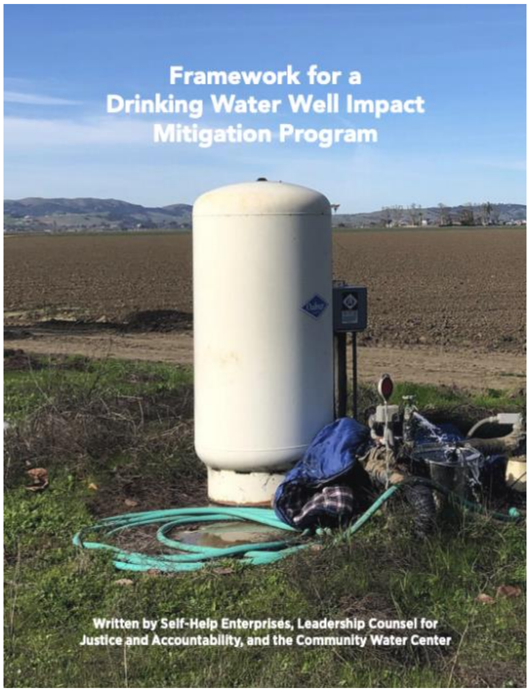


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	**Yes/No**
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

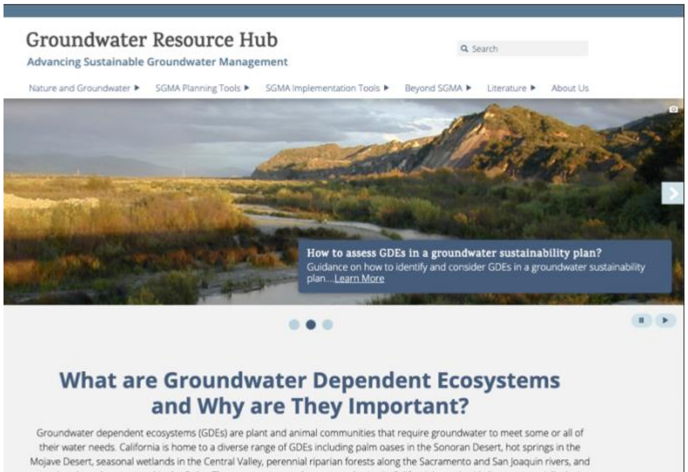
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



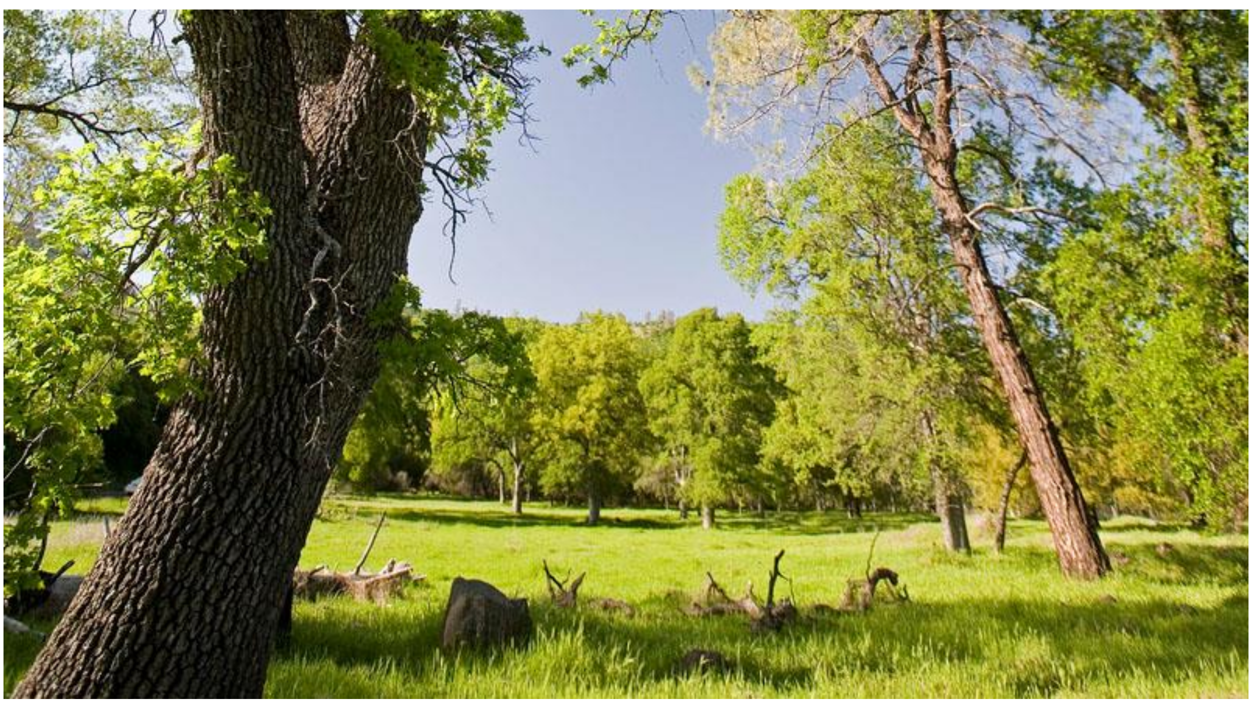
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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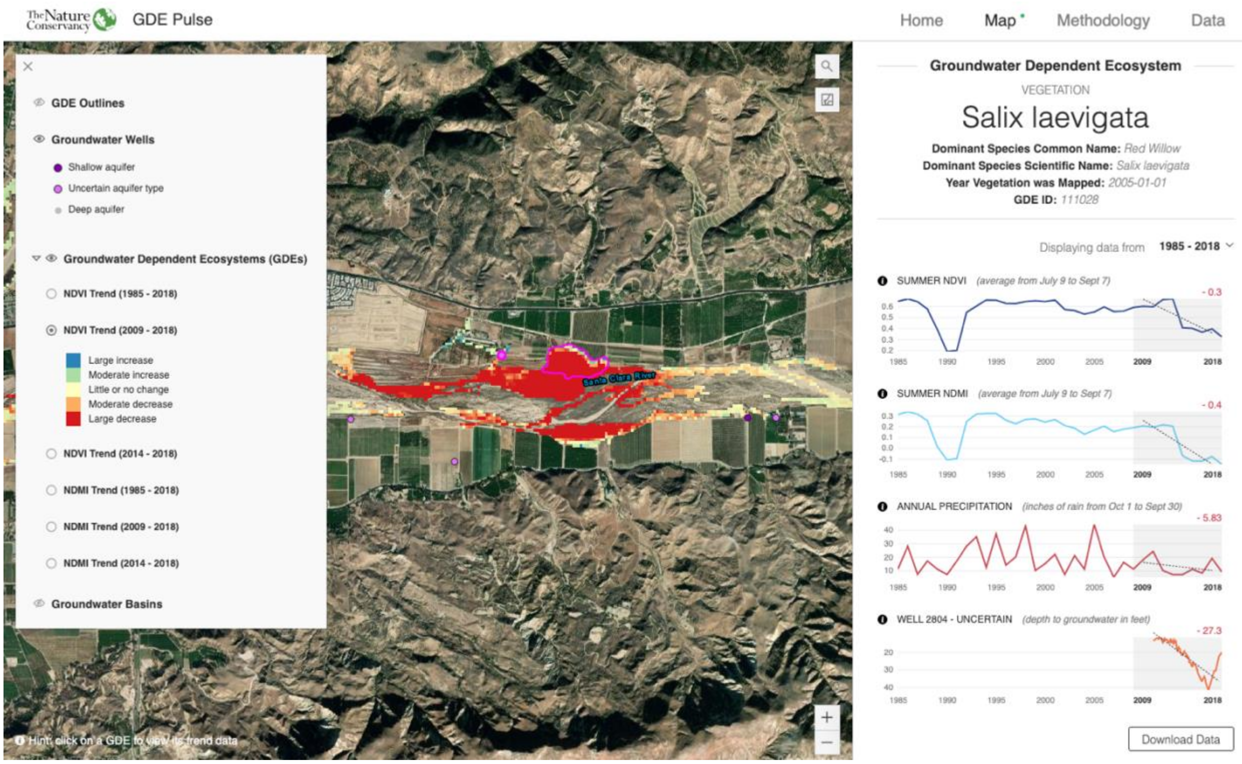
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

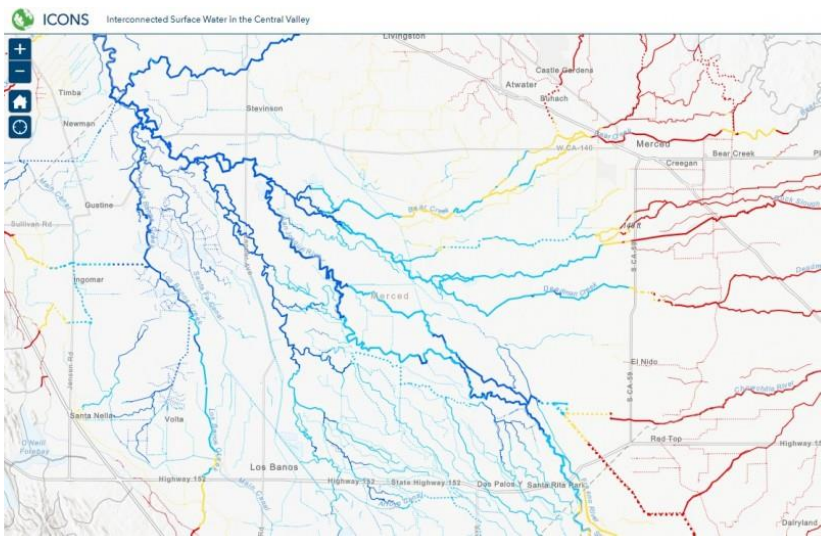
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Yucaipa Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Yucaipa Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	**State**	**Other**
BIRDS				
Actitis macularius	Spotted Sandpiper			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris minutilla	Least Sandpiper			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Empidonax traillii extimus	Southwestern Willow Flycatcher	Endangered	Endangered	
Fulica americana	American Coot			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Setophaga petechia brewsteri	A Yellow Warbler	Bird of Conservation Concern	Special Concern	
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Vireo bellii	Bell's Vireo			
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
CRUSTACEANS				
Hyalella spp.	Hyalella spp.			
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern	ARSSC
Pseudacris cadaverina	California Treefrog			ARSSC

Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Rana muscosa	Southern Mountain Yellow-legged Frog	Endangered	Candidate Endangered	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
INSECTS & OTHER INVERTS				
Apedilum spp.	Apedilum spp.			
Argia spp.	Argia spp.			
Baetidae fam.	Baetidae fam.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Belostomatidae fam.	Belostomatidae fam.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Cricotopus spp.	Cricotopus spp.			
Cricotopus trifascia				Not on any status lists
Cryptochironomus spp.	Cryptochironomus spp.			
Ephydridae fam.	Ephydridae fam.			
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Hydropsyche spp.	Hydropsyche spp.			
Hydropsychidae fam.	Hydropsychidae fam.			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Laccobius spp.	Laccobius spp.			
Laccophilus spp.	Laccophilus spp.			
Limnophyes spp.	Limnophyes spp.			
Micropsectra spp.	Micropsectra spp.			
Narpus spp.	Narpus spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Pentaneura spp.	Pentaneura spp.			
Polypedilum spp.	Polypedilum spp.			
Pseudosmittia spp.	Pseudosmittia spp.			
Psychodidae fam.	Psychodidae fam.			
Rheotanytarsus spp.	Rheotanytarsus spp.			

Simuliidae fam.	Simuliidae fam.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Tanytarsus spp.	Tanytarsus spp.			
Tipulidae fam.	Tipulidae fam.			
Zaitzevia spp.	Zaitzevia spp.			
MOLLUSKS				
Physa spp.	Physa spp.			
Pyrgulopsis californiensis	Laguna Mountain Springsnail			V
PLANTS				
Alnus rhombifolia	White Alder			
Arundo donax	NA			
Eleocharis coloradoensis				Not on any status lists
Juncus dubius	Mariposa Rush			
Juncus rugulosus	Wrinkled Rush			
Juncus xiphioides	Iris-leaf Rush			
Myriophyllum aquaticum	NA			
Myriophyllum sibiricum	Common Water-milfoil			
Persicaria lapathifolia				Not on any status lists
Phacelia distans	NA			
Rumex violascens	Violet Dock			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

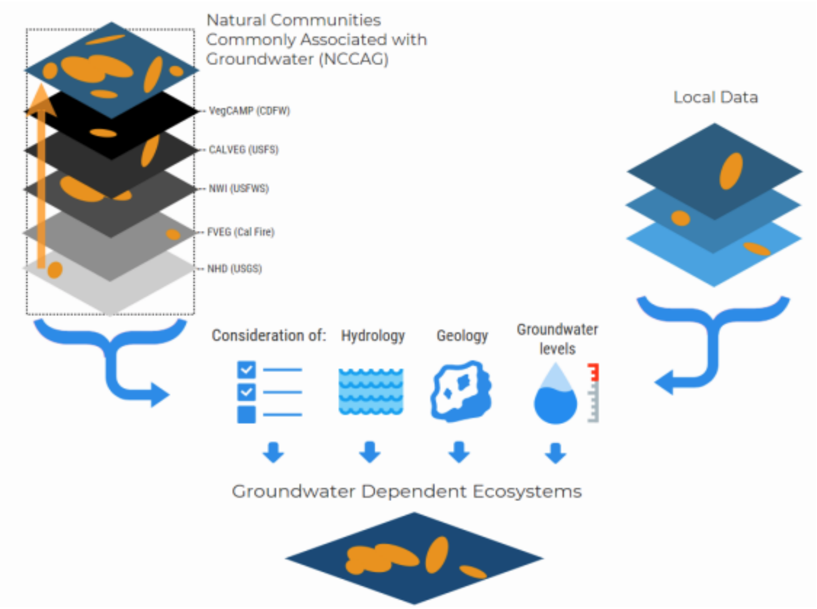


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

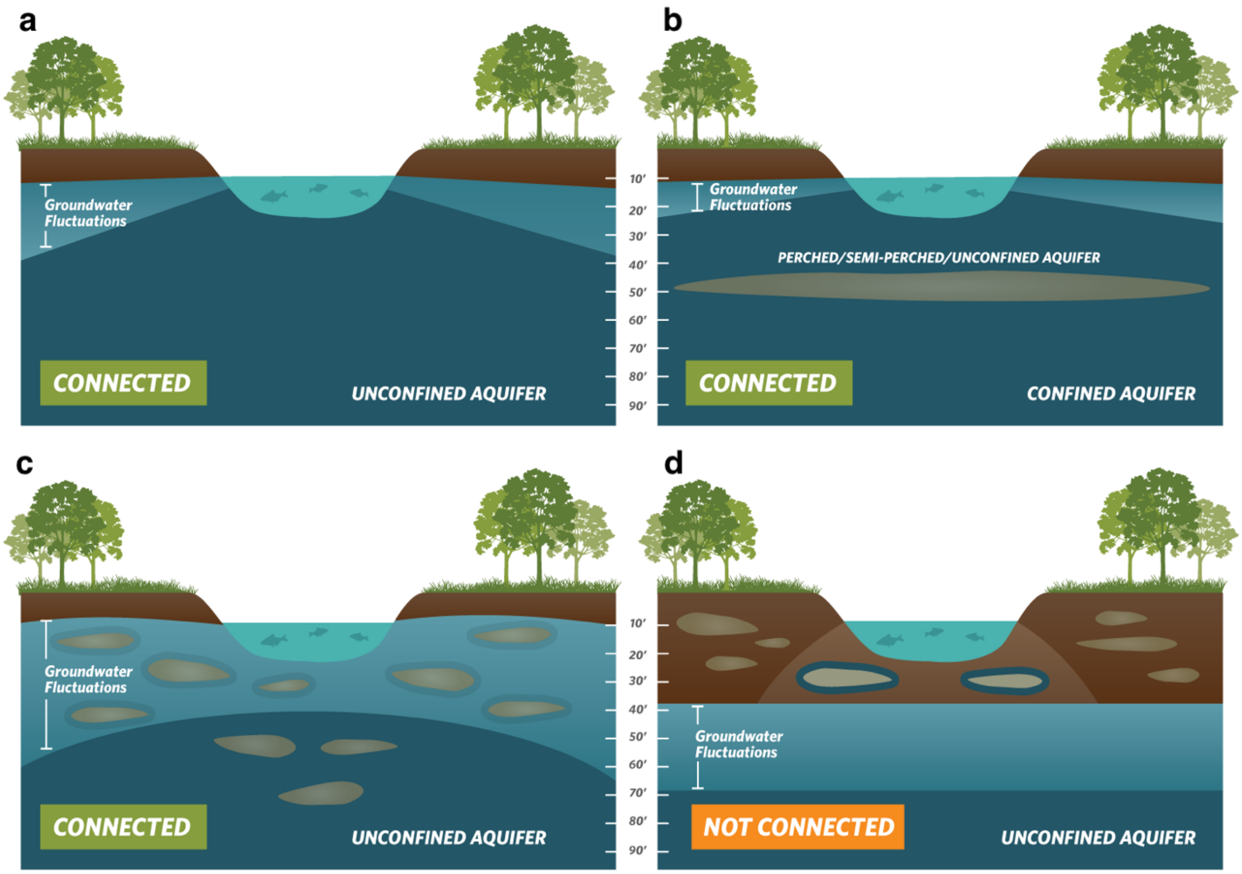

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

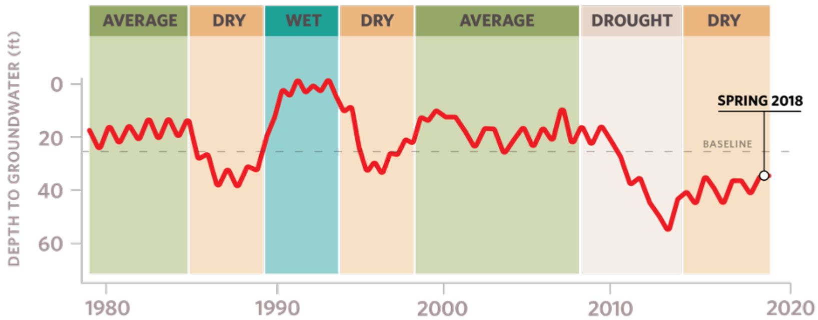

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

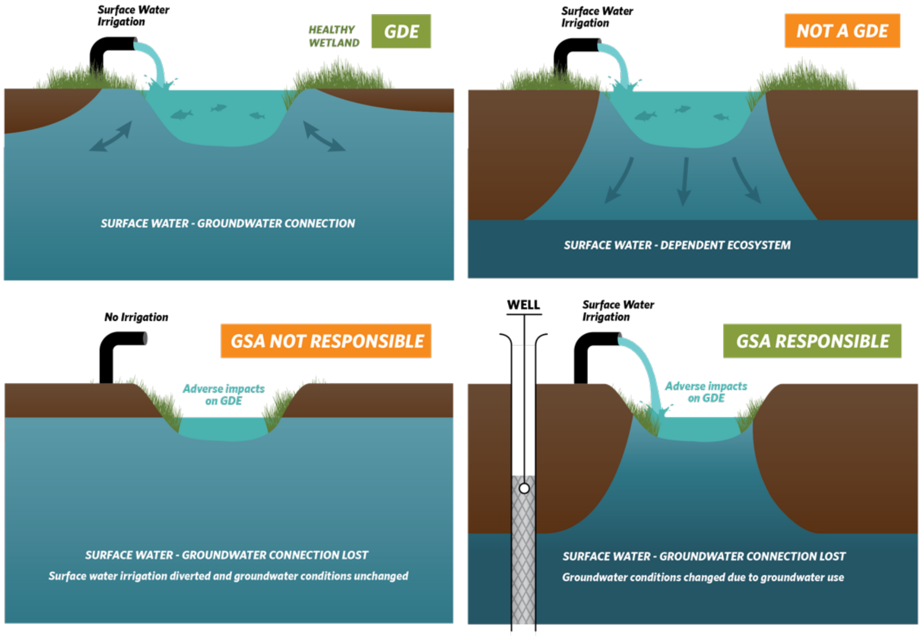

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

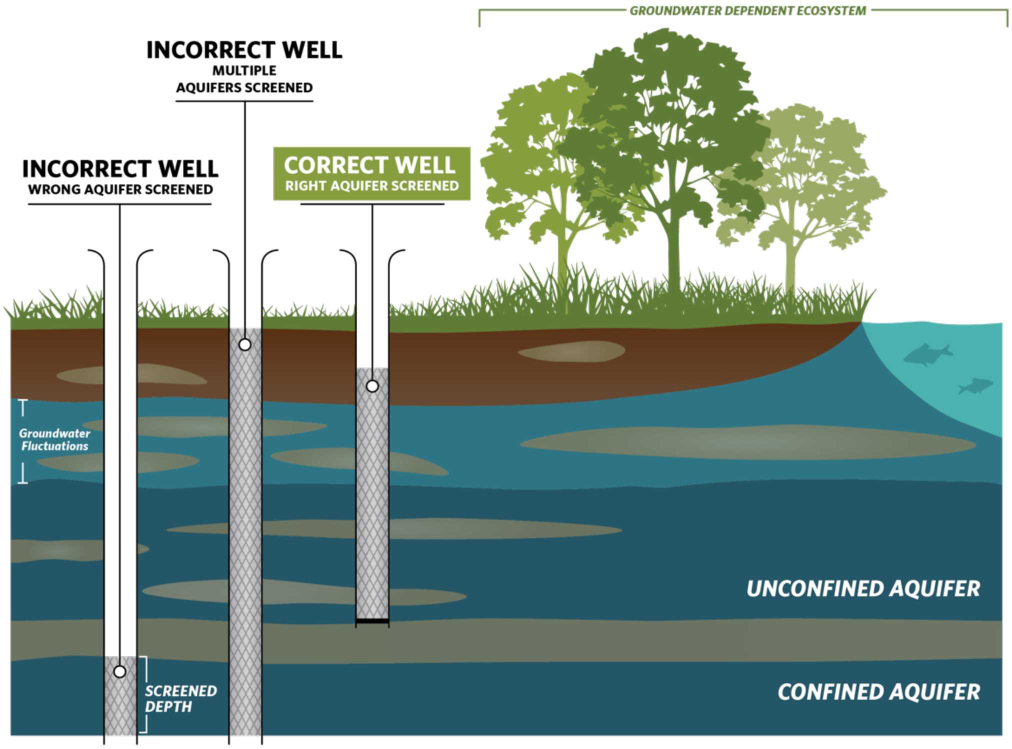

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

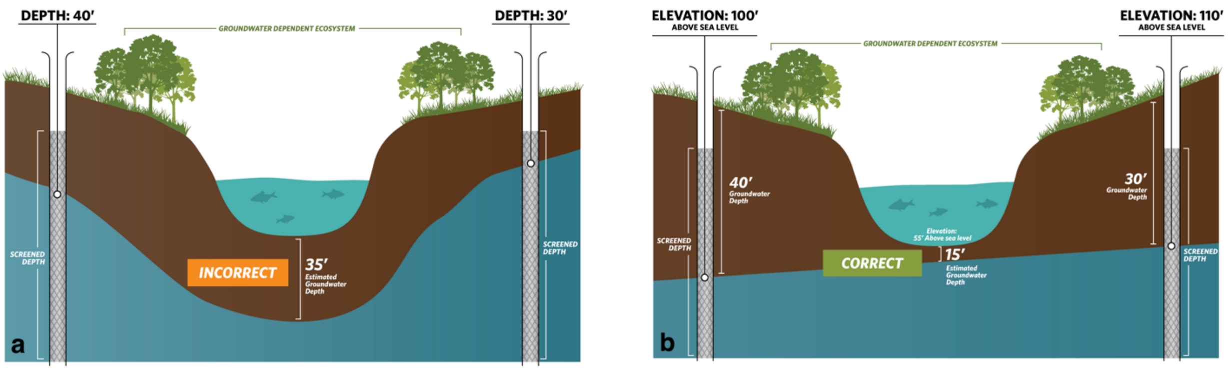

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

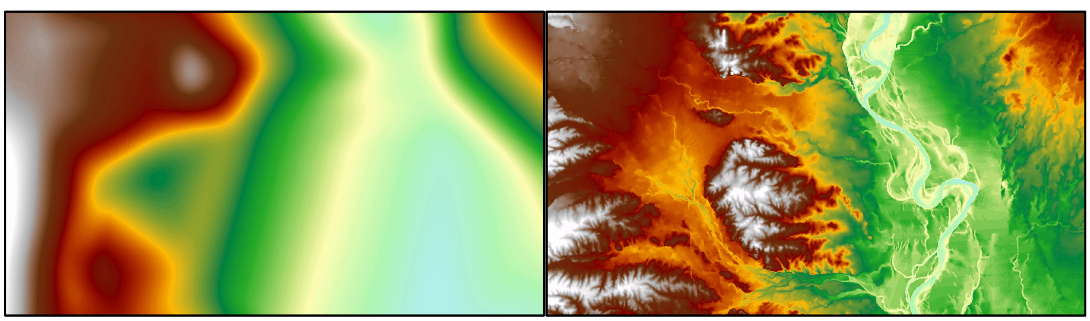

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

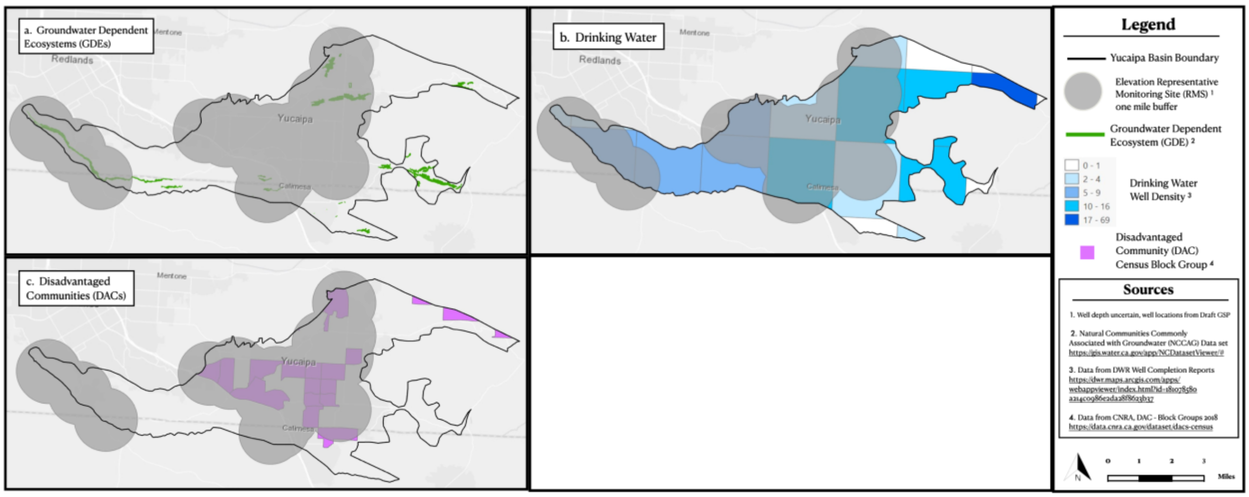

Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

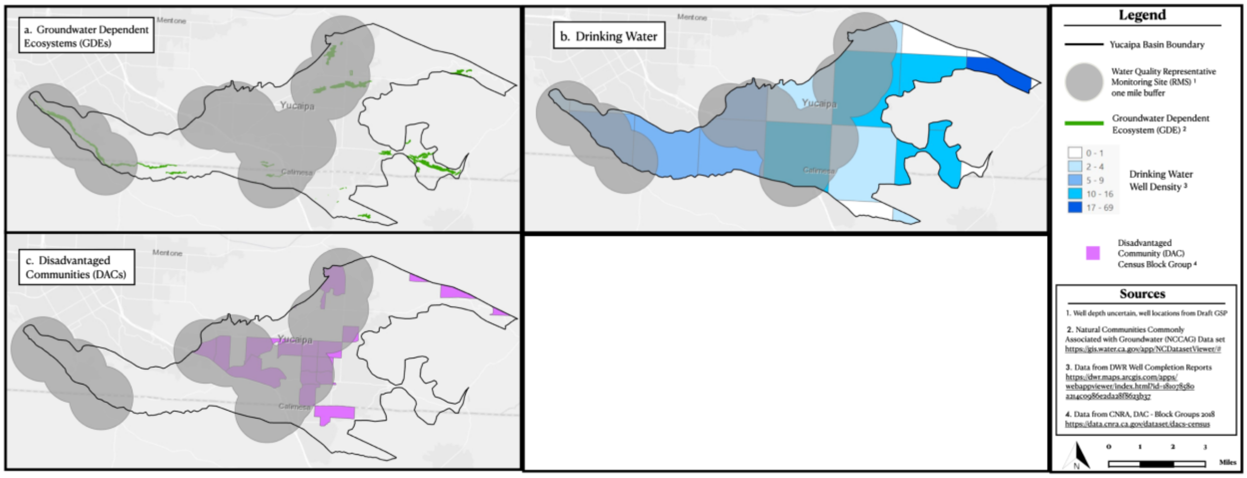

Figure 2. Groundwater quality representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.